

Lymphoid organs

Lymphoid organs

- 1-Primary (central) lymphoid organs:

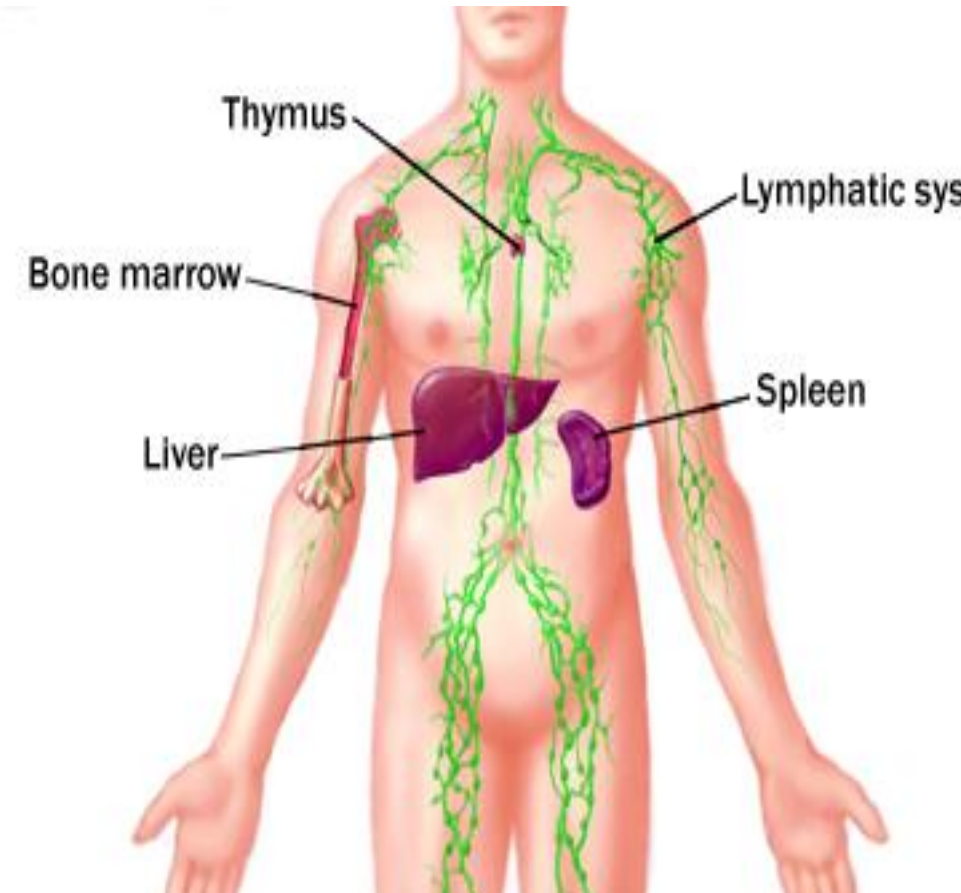
- >> *Formation* of lymphocytes.

- Thymus.
- Bone marrow.

- 2-Secondary (peripheral) lymphoid tissues:

>>*activated (react with foreign antigens):*

- Lymph nodes.
- Spleen.
- MALT.



Thymus

Thymus

- **Site:** in the superior mediastinum behind the sternum.
- It is active in childhood but it progressively atrophies at puberty where most of the lymphoid tissue is replaced by adipose tissue.

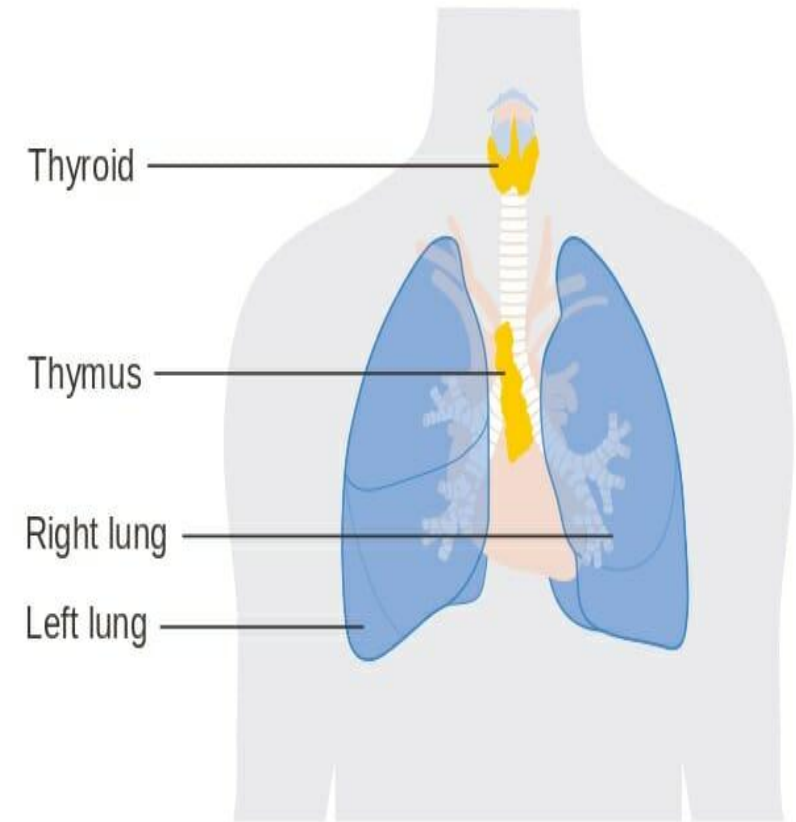
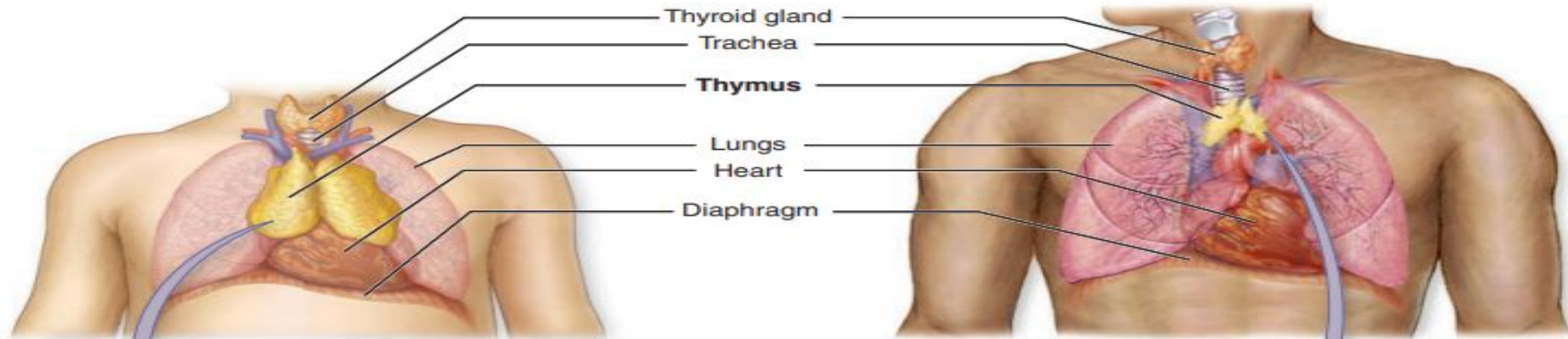
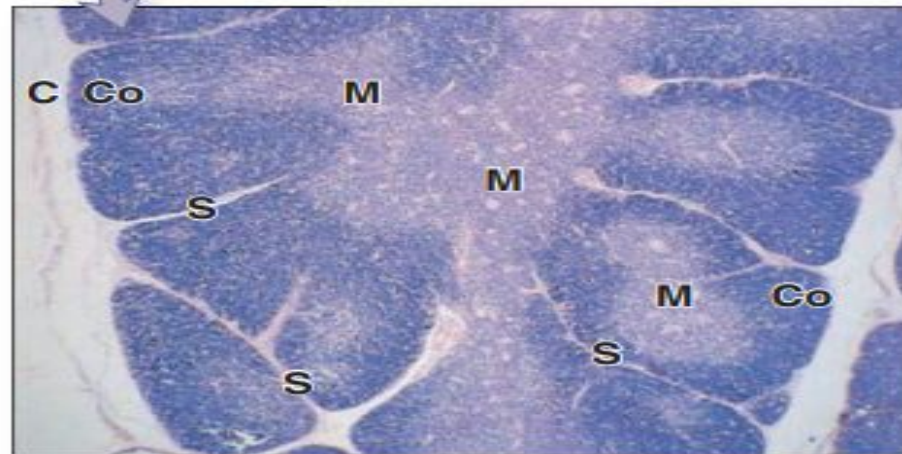


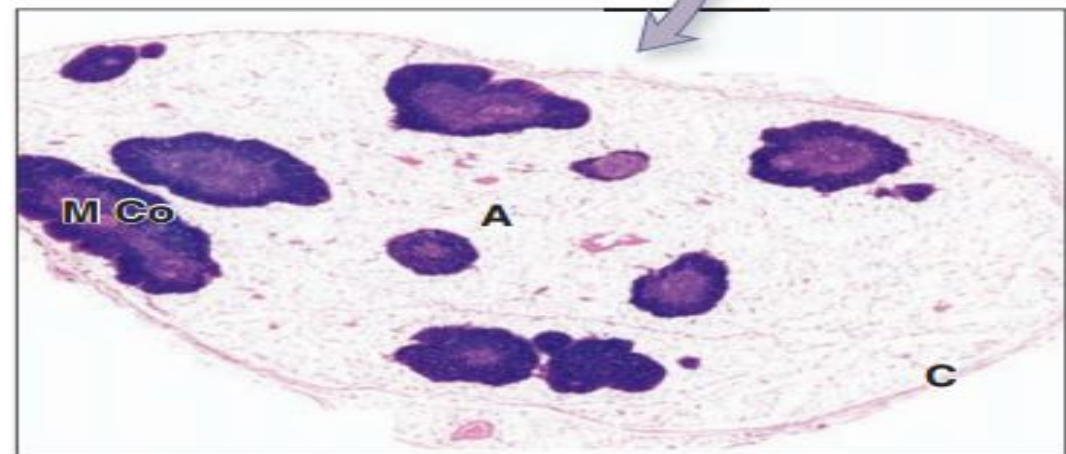
FIGURE 14–8 Thymus.



(a) Child (left) and adult (right) thorax, anterior view



(b) Micrograph of child's thymus



(c) Micrograph of adult's thymus

(a) The thymus, a bilobed organ located in the superior mediastinum, is most prominent and active before puberty, undergoing gradual shrinkage (involution) and loss of activity in adults.

(b) A child's thymus, showing connective tissue of the capsule (**C**) and septa (**S**) between thymic lobules, each having an outer cortex (**Co**) and incompletely separated medulla (**M**) of lymphoid tissue. (H&E; X40)

(c) After involution the thymus shows only small regions of lymphoid tissue, here still with cortex (**Co**) and medulla (**M**), and these are embedded in adipose tissue (**A**). Age-related thymic involution reduces production of naïve T cells and may be involved with the decline of immune function in the elderly. (H&E; X24)

Histological structure of Thymus

Stroma

Parenchyma



Histological structure of Thymus

Stroma

- The supportive framework
- Connective tissue



Parenchyma

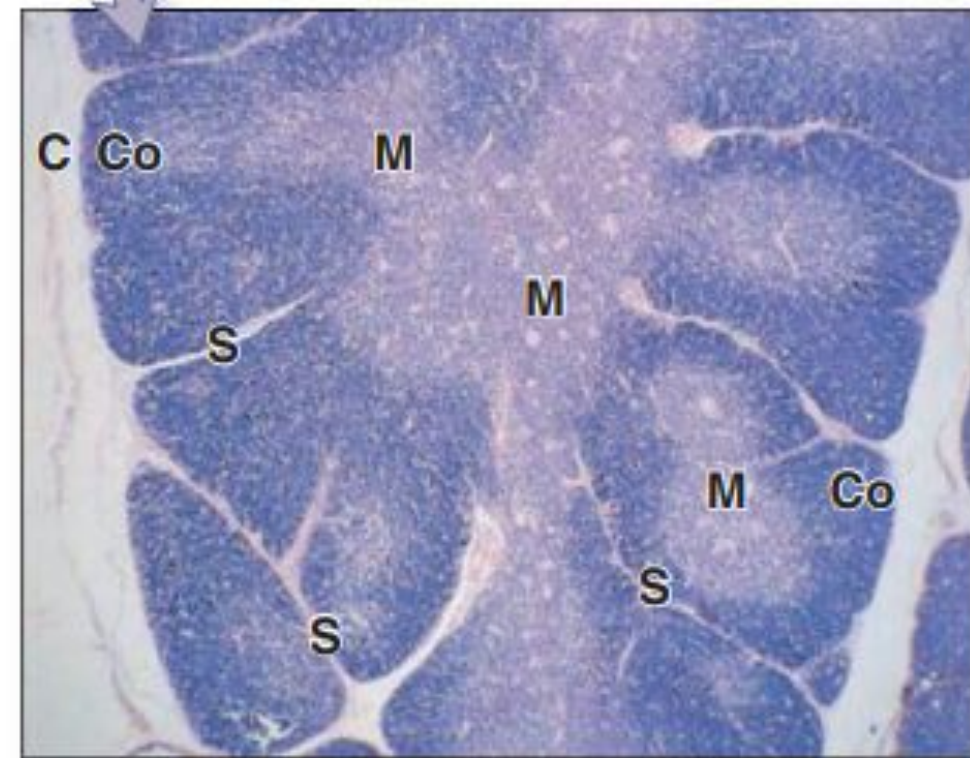
The functional part of the organ

Epith, Muscle, Neural tissues

Histological structure of the thymus

- **Stroma:**

- Connective tissue capsule.
- Connective tissue septa (trabeculae) extend into the parenchyma → divide it into incomplete lobules.



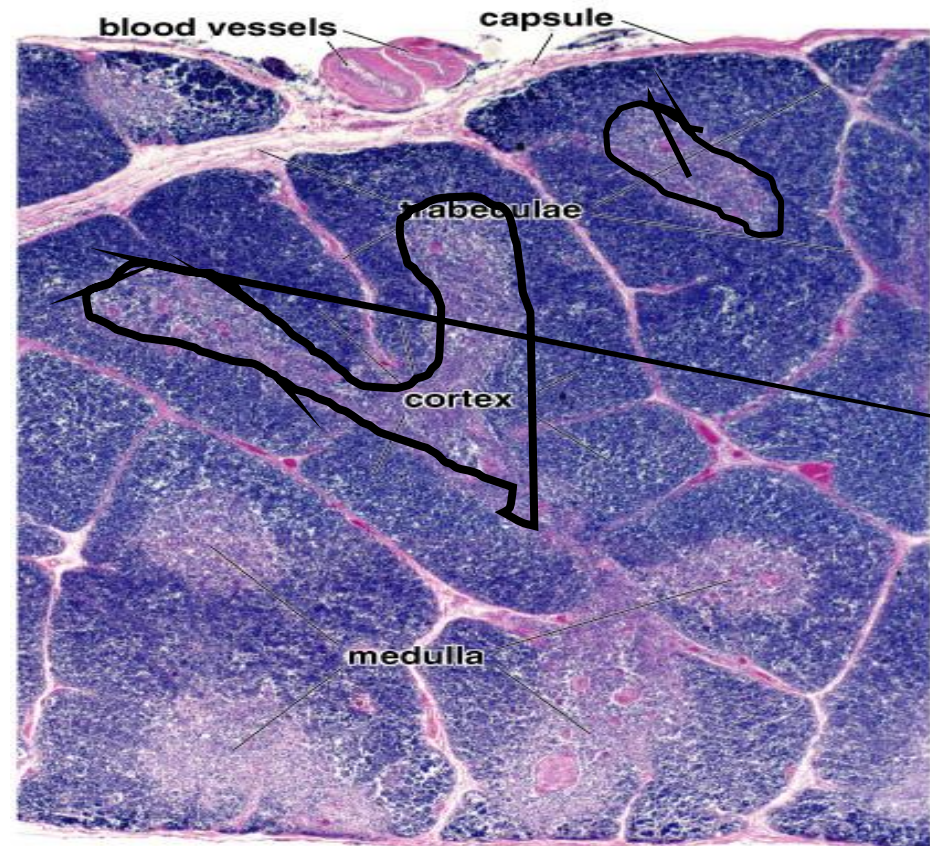
(b) Micrograph of child's thymus



Histological structure of the thymus

- **Parenchyma:** each lobule is divided into:

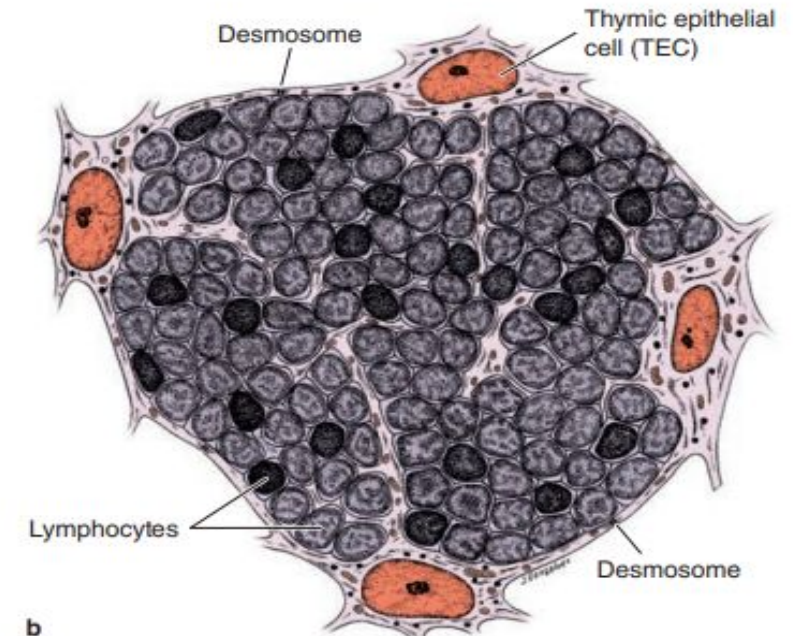
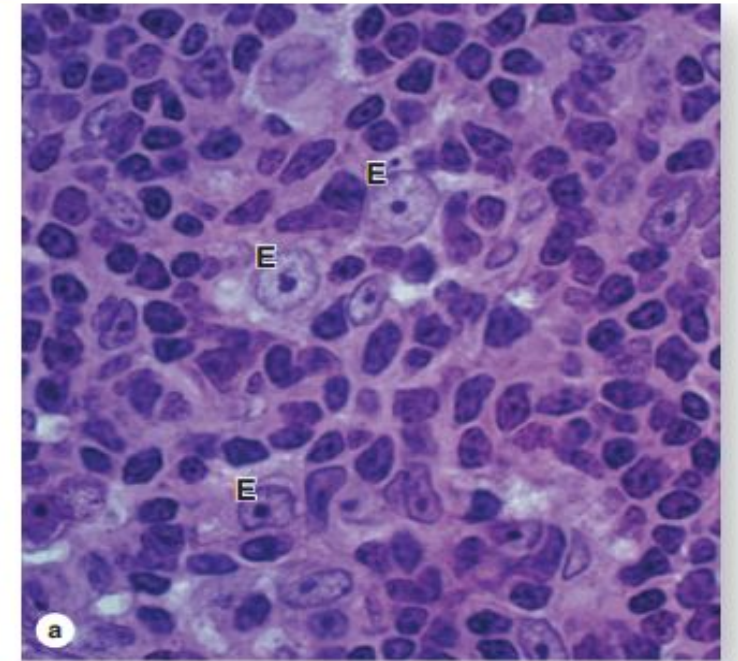
- A peripheral dark cortex.
- An inner pale medulla.



I-The thymic cortex

- The cortex is darkly stained because of densely packed cells.
- It is composed of:
 1. *Thymocytes (T-Lymphoblasts)*
 2. *Thymic Epithelial cells (TECs) :*
 - Epithelial /reticular cells

Macrophages.



I-The thymic cortex

- 3 types/functions of TECs :

- **Blood-thymus barrier:**

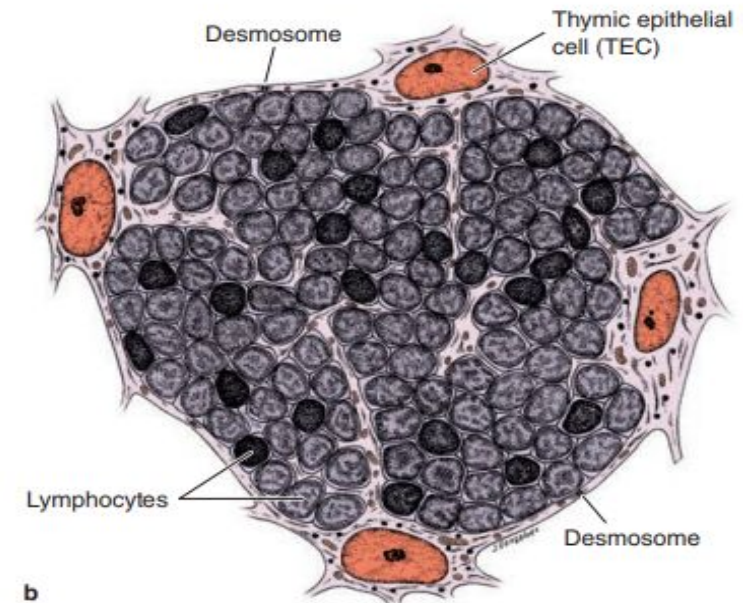
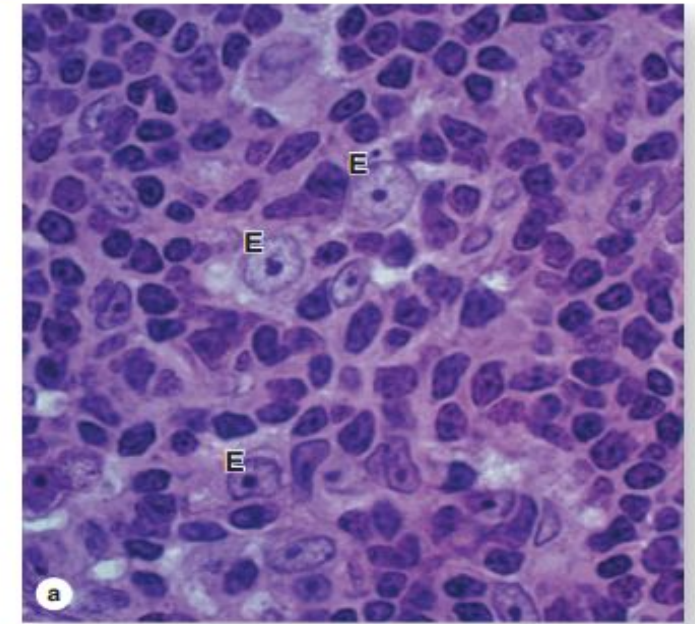
To prevents the **foreign antigens** from reaching the thymic cortex where T lymphocytes are still in state of maturation.

- **Cytoreticulum :**

to which **macrophages** and developing lymphocytes attach (**APCs**). They also secrete numerous cytokines for T-cell development and other immune functions (**Thymic endocrine function**)

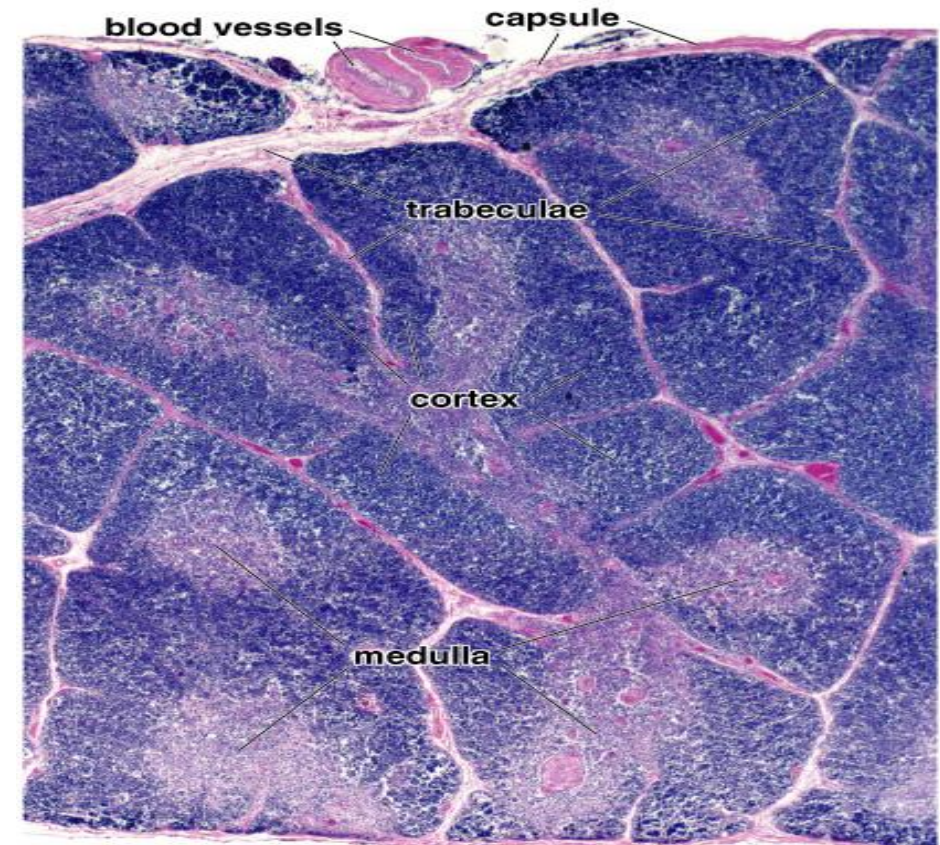
- **Corticomedullary barrier:**

Squamous TECs also express MHC class II molecules but form a sheetlike structure contributing to a **functional corticomedullary barrier**.



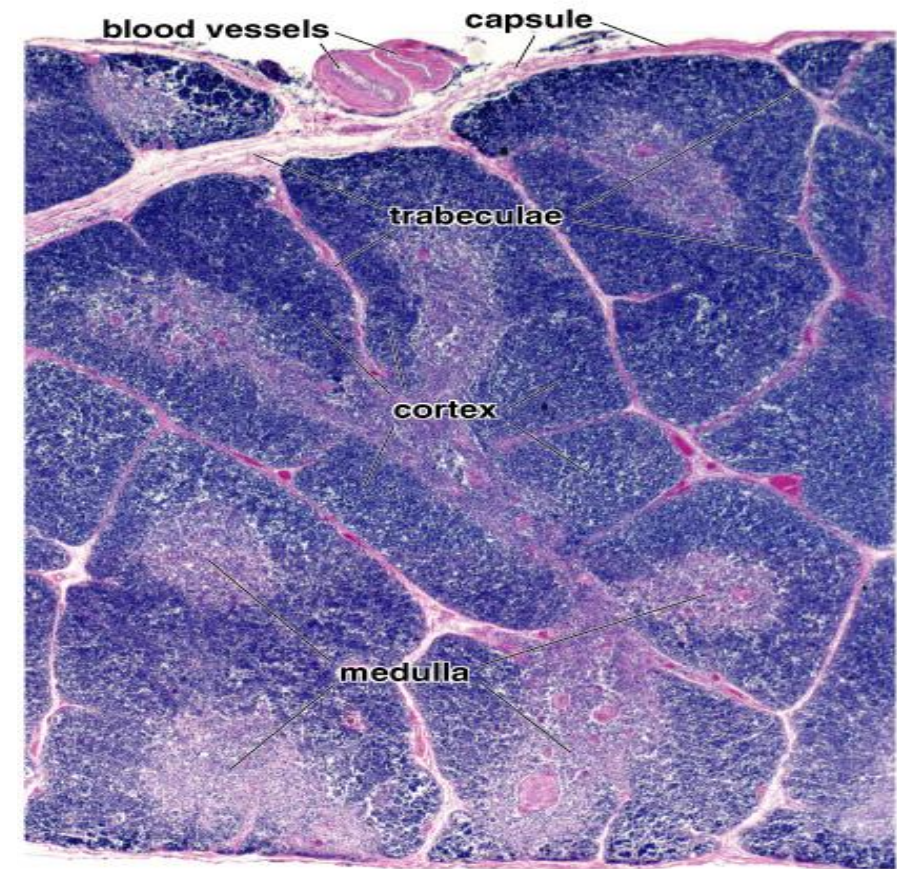
II- Thymic medulla

- The medulla is pale because of its loosely- packed cells.
- The medulla of adjacent lobules is connected together due to the incomplete lobulation of the gland.
- Consist of T-lymphocytes and TECs



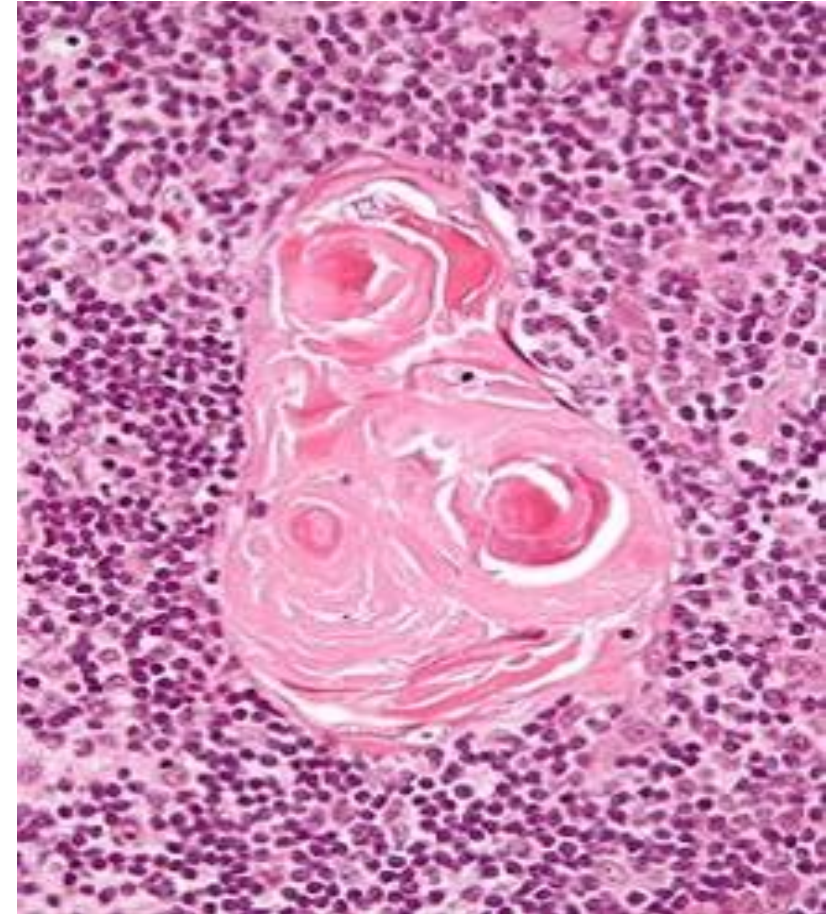
II- Thymic medulla

- 3 types of medullary TECs :
 - A second layer of the boundary between **cortex and medulla**.
 - **A cytotreticulum :**
Supports T lymphocytes, dendritic cells, and macrophages
 - **Hassall corpuscles:**
Large aggregates of TECs, sometimes concentrically arranged



Hassall's corpuscles

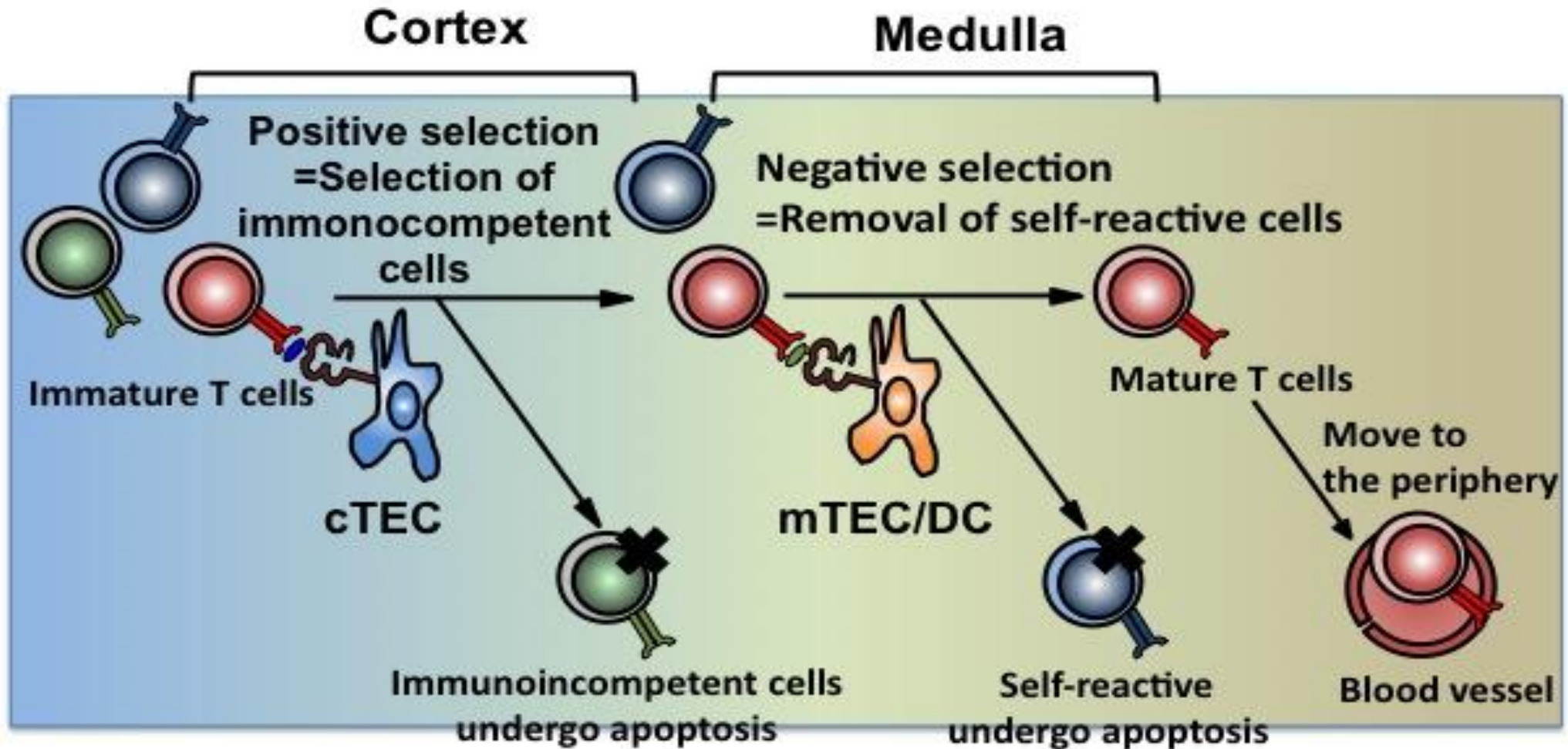
- **Site:** in the medulla of the thymus.
- **Structure:**
 - Large Concentric aggregates of TECs
- **Function:** not fully understood.
- secrete several **cytokines** that control activity of local dendritic cells, and regulates T cells peripheral tolerance.



II- Thymic medulla

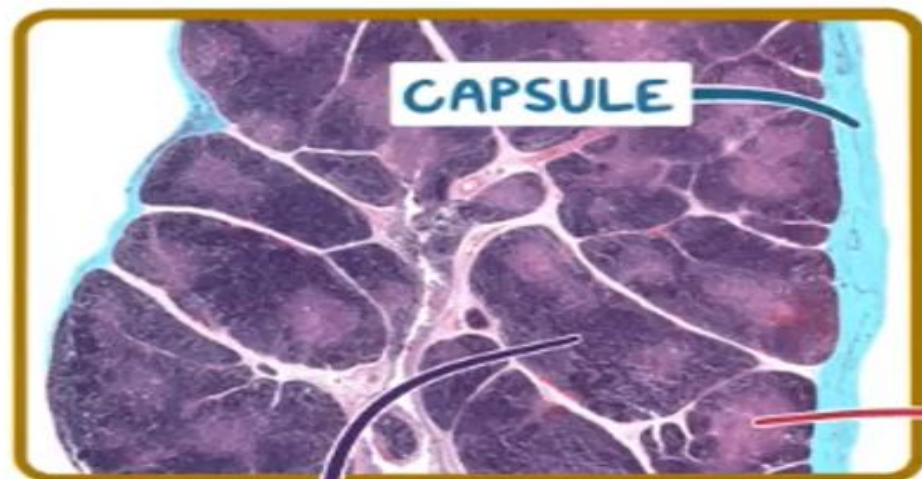
- The microvasculature of the medulla is not surrounded by a tight layer of TECs, and **mature T lymphocytes** exit the thymus by passing through the walls of **venules and efferent lymphatics** in this region

T cell maturation

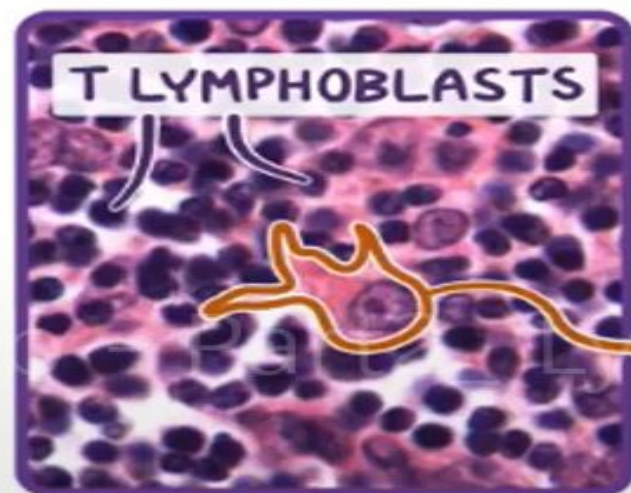


THYMUS

- * FLAT ENCAPSULATED LYMPHOID ORG
- * LOCATED BEHIND the STERNUM
- * MOST ACTIVE & LARGEST DURING CHILDHOOD

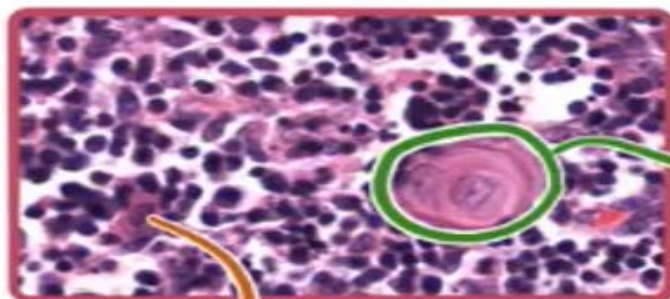


CORTEX
(VERY BASOPHILIC)



T LYMPHOBLASTS

MEDULLA
(LIGHTER PURPLE & PINK)



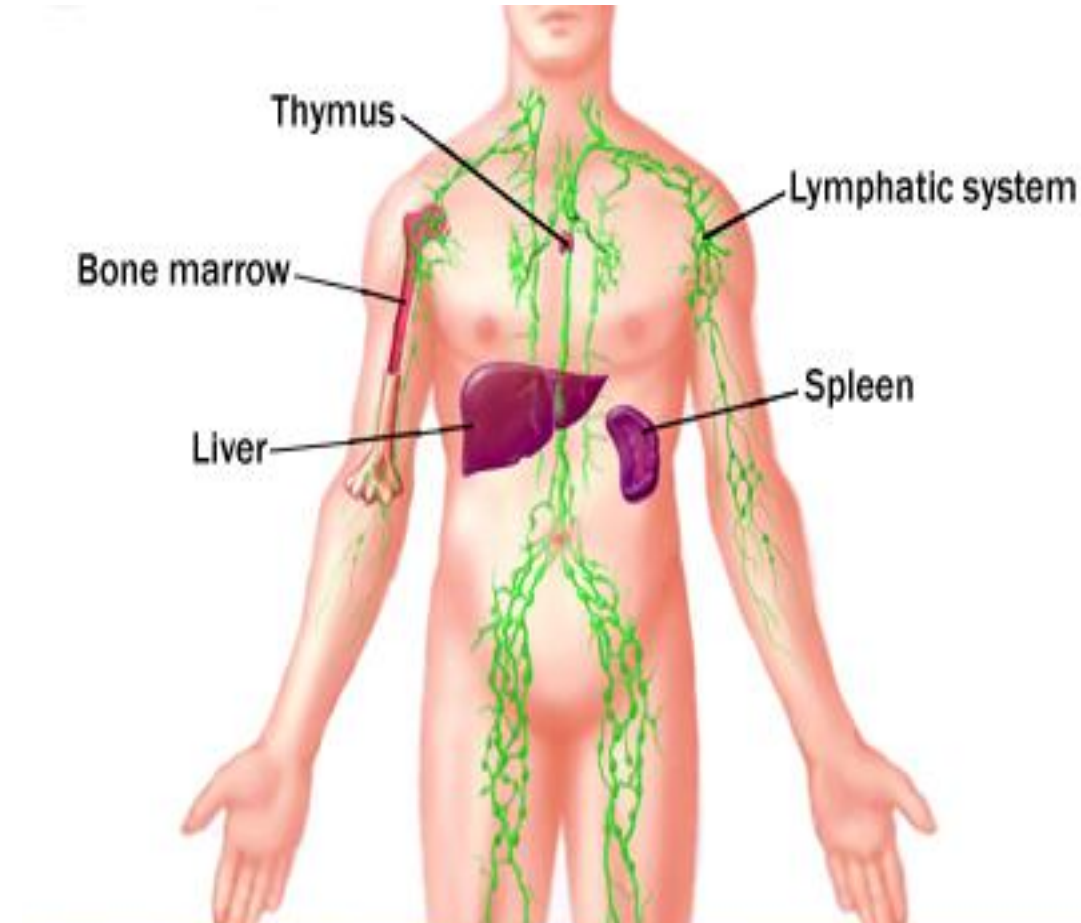
HASSALL'S CORPUSCLES
~ CLOSELY PACKED & CONCENTRICALLY ARR

THYMIC EPITHELIAL CELLS ~ PALE CYTOPLASM with CY

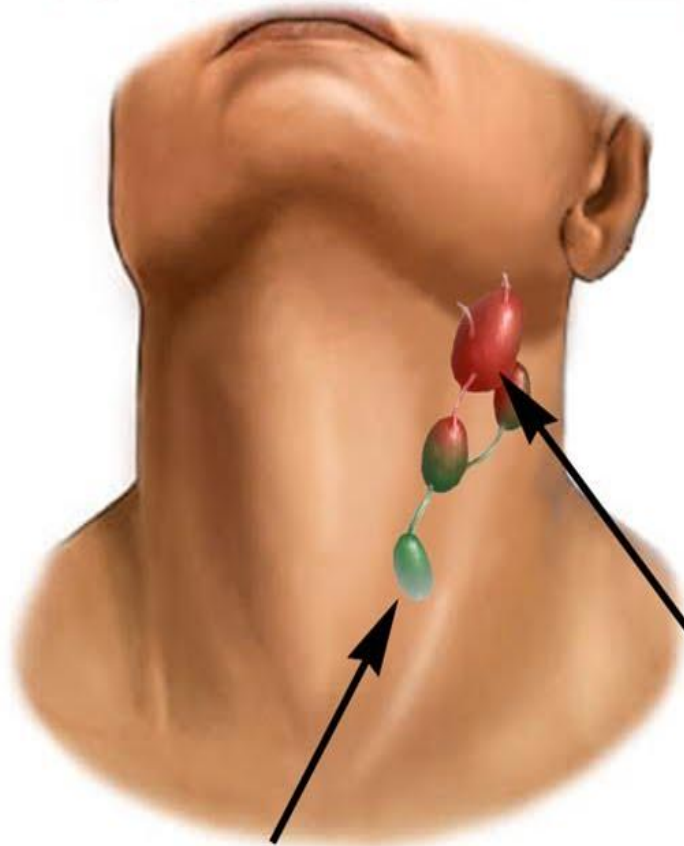
Lymph nodes

Lymph nodes

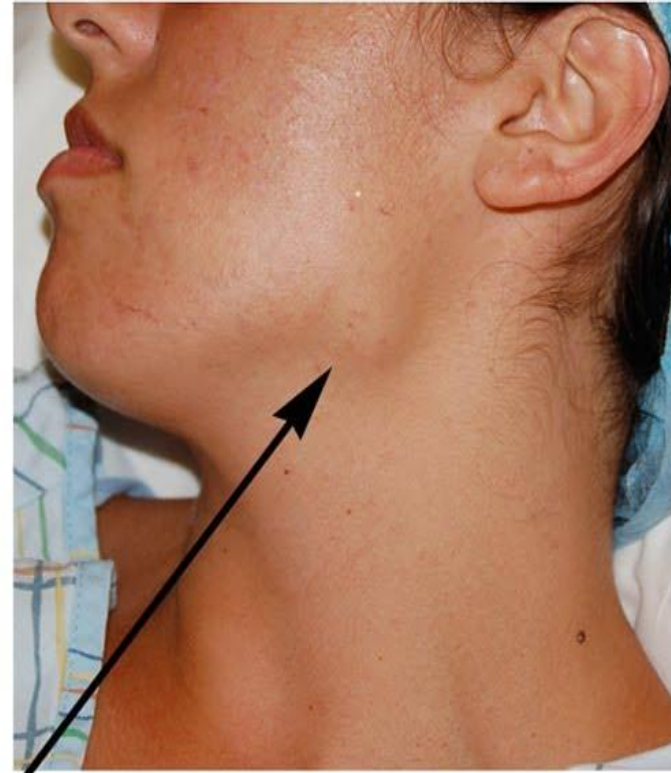
- **Site:** They are located along the course of the lymphatic vessels.
- 400-450
- **Function:** filtration of the lymph.
small kidney shaped bodies



Swollen Lymph Nodes



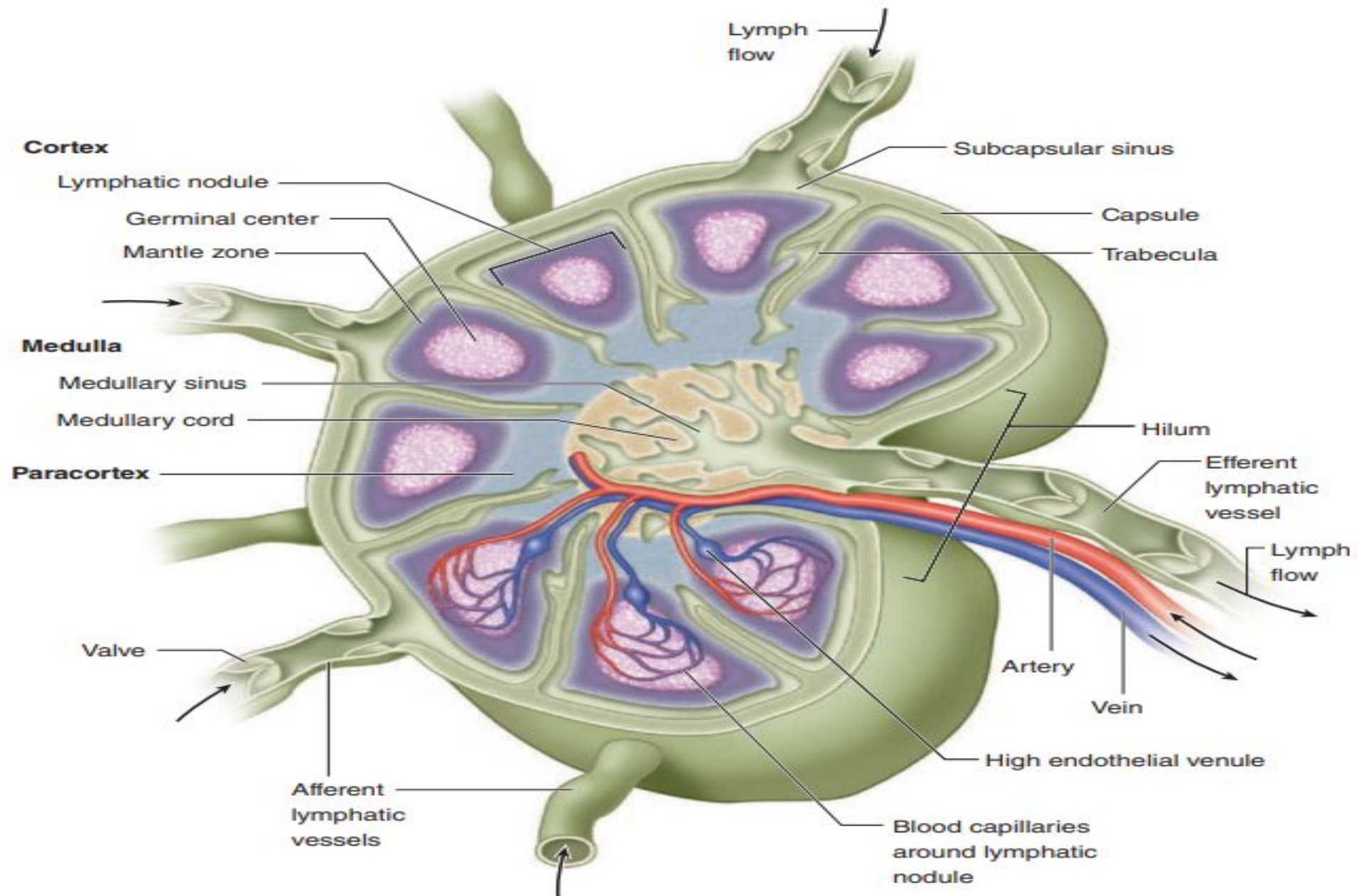
Normal Lymph Node



Abnormal Lymph Nodes

Lymphadenopathy

FIGURE 14–15 Lymph node.



I- Stroma

Capsule



Trabeculae

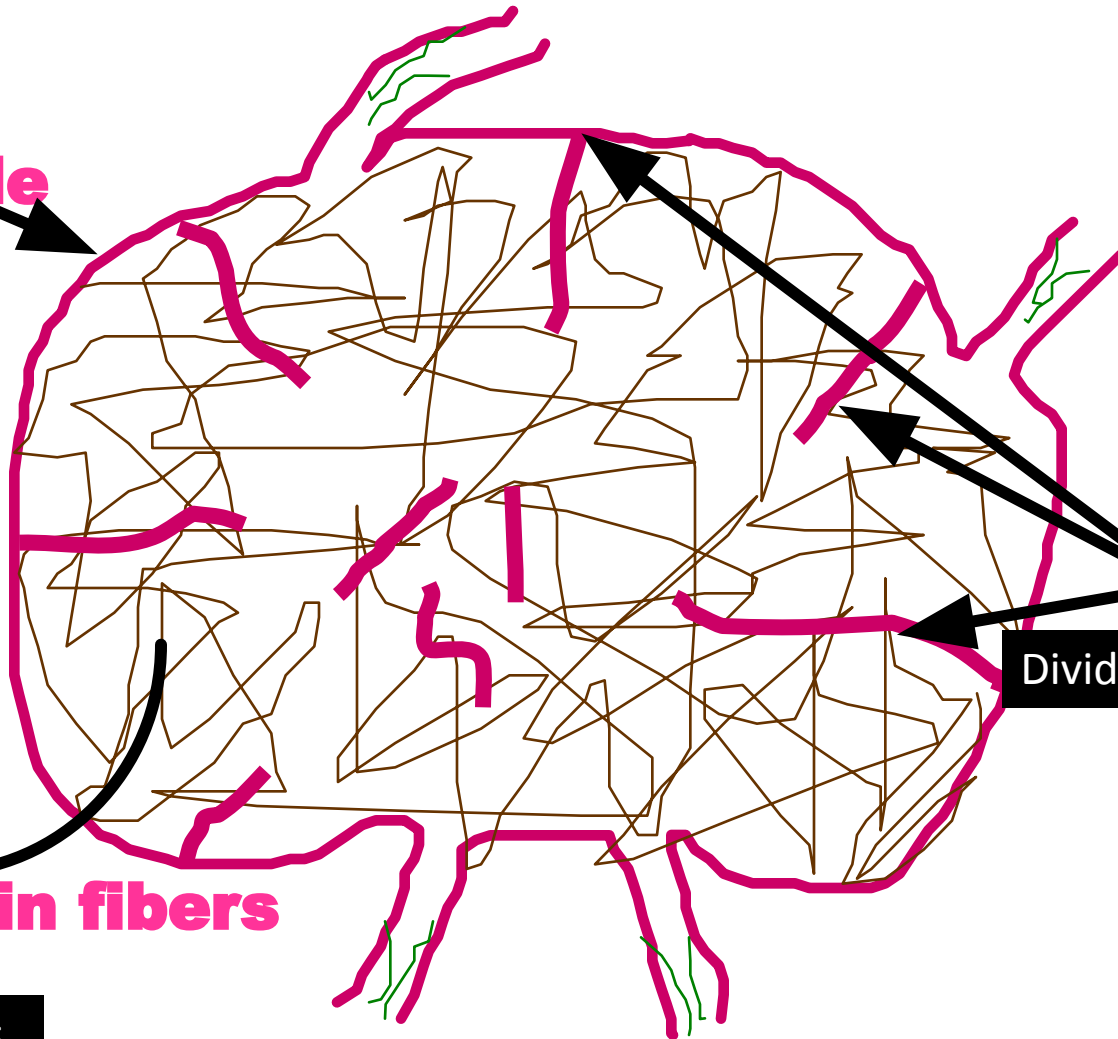


Divide the cortex into compartments.

Reticulin fibers



Support the parenchymal cells



II-Parenchyma

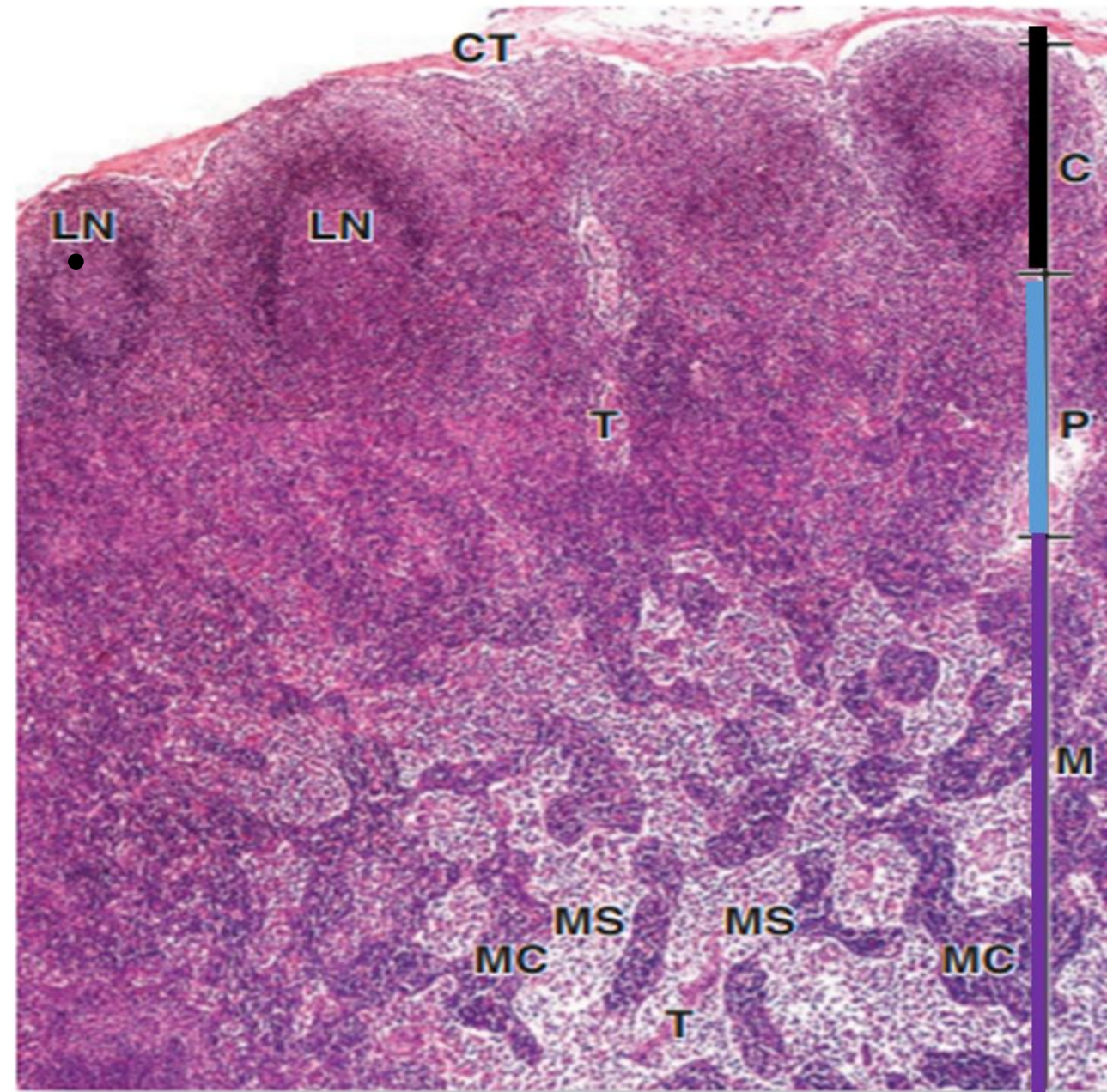
- It is divided into :

A- Outer cortex:

B-Paracortex

C-Medulla

FIGURE 14–16 Regions of a lymph node.



II-Parenchyma

A- Outer cortex:

Receiving lymph from afferent lymphatics & containing lymphatic nodules

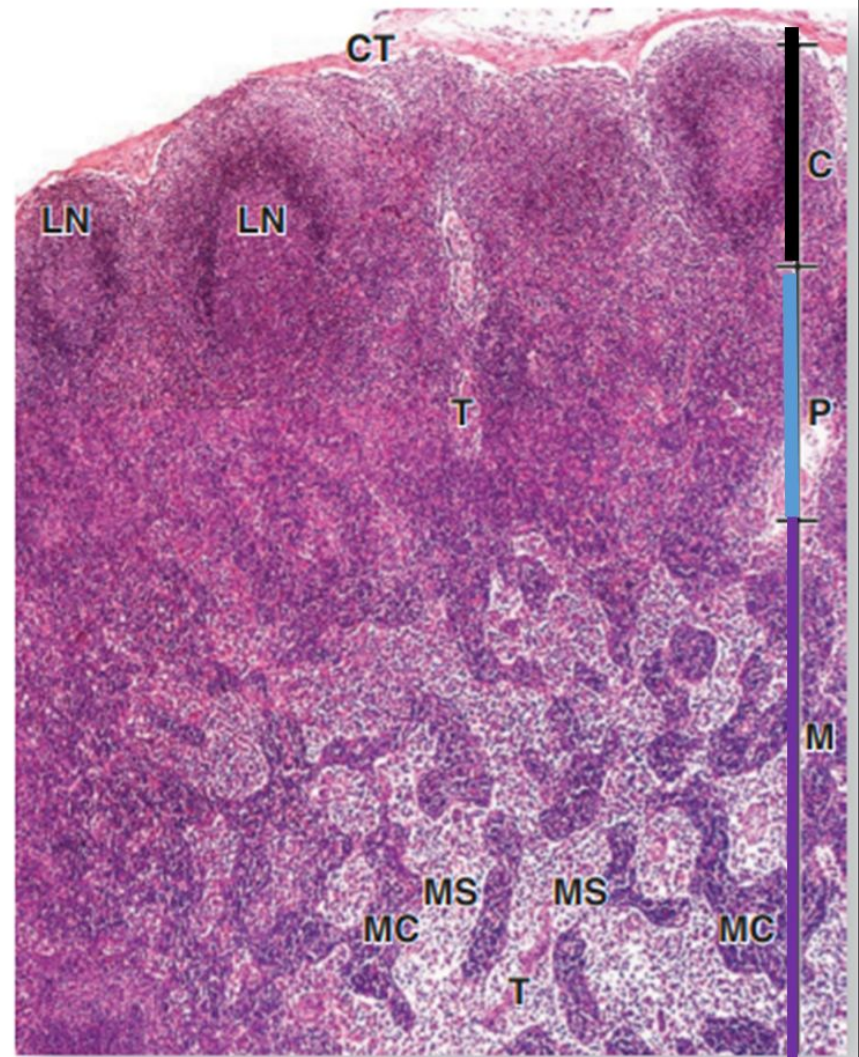
B-Paracortex:

Where lymphocytes enters high endothelial venules (HEVs)

C-Medulla

Sinuses converging at the efferent lymphatic

FIGURE 14–16 Regions of a lymph node.





The outer cortex

A- subcapsular sinus:

Receiving lymph from afferent lymphatics

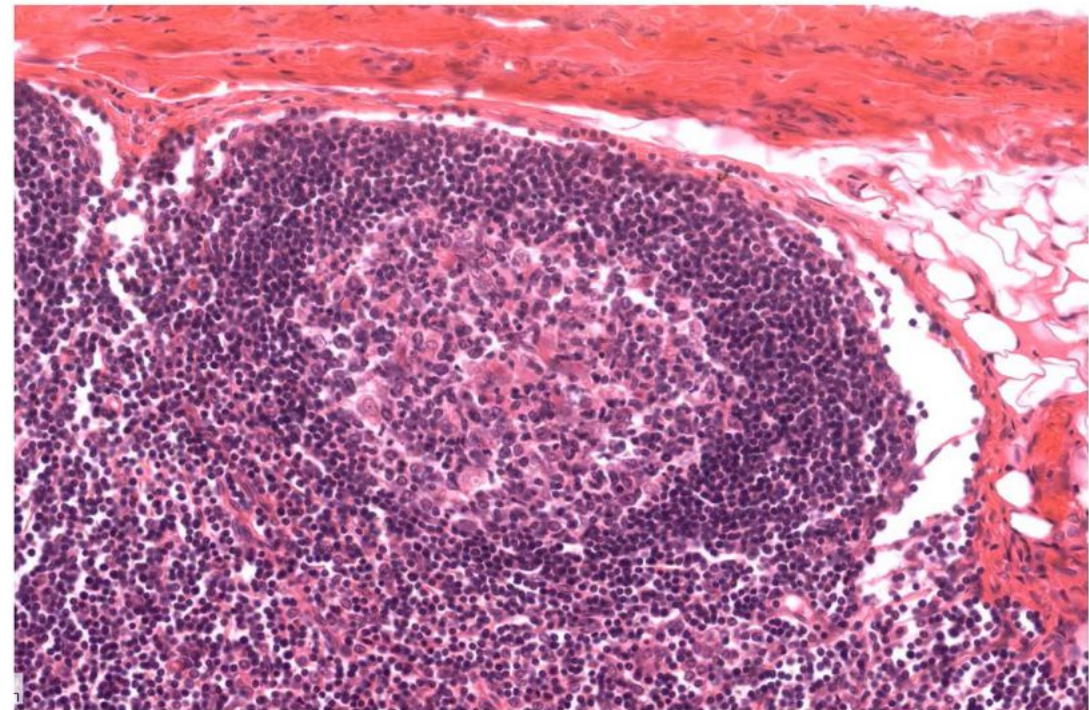
From this spaces **cortical sinuses (trabecular)** branched

B-Lymphoid nodules:

Spherical clusters of **developing B-lymphocytes**

Germinal center :lighter area where B lymphocytes differentiated to **Plasma cells**

Macrophages



II-Paracortex

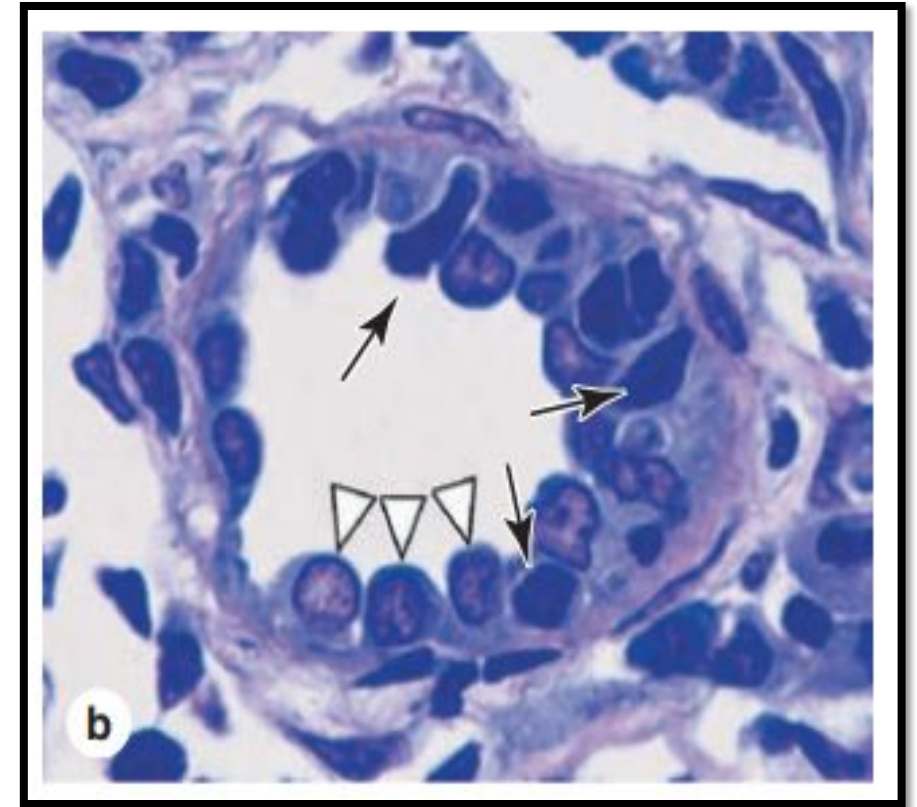
- No lymph nodules*

- Rich in T-cells*

- High endothelial venules:**

From where 90% of the circulating lymphocytes enters the LN.

- enlarged cuboidal endothelial cells



III-Medulla

Medullary cords

- Branched cord like structures
- B, T lymphocytes, plasma cells & MO

Medullary sinuses:

- Dilated spaces separating the medullary cords
- converge at the hilum as the efferent lymph vessel

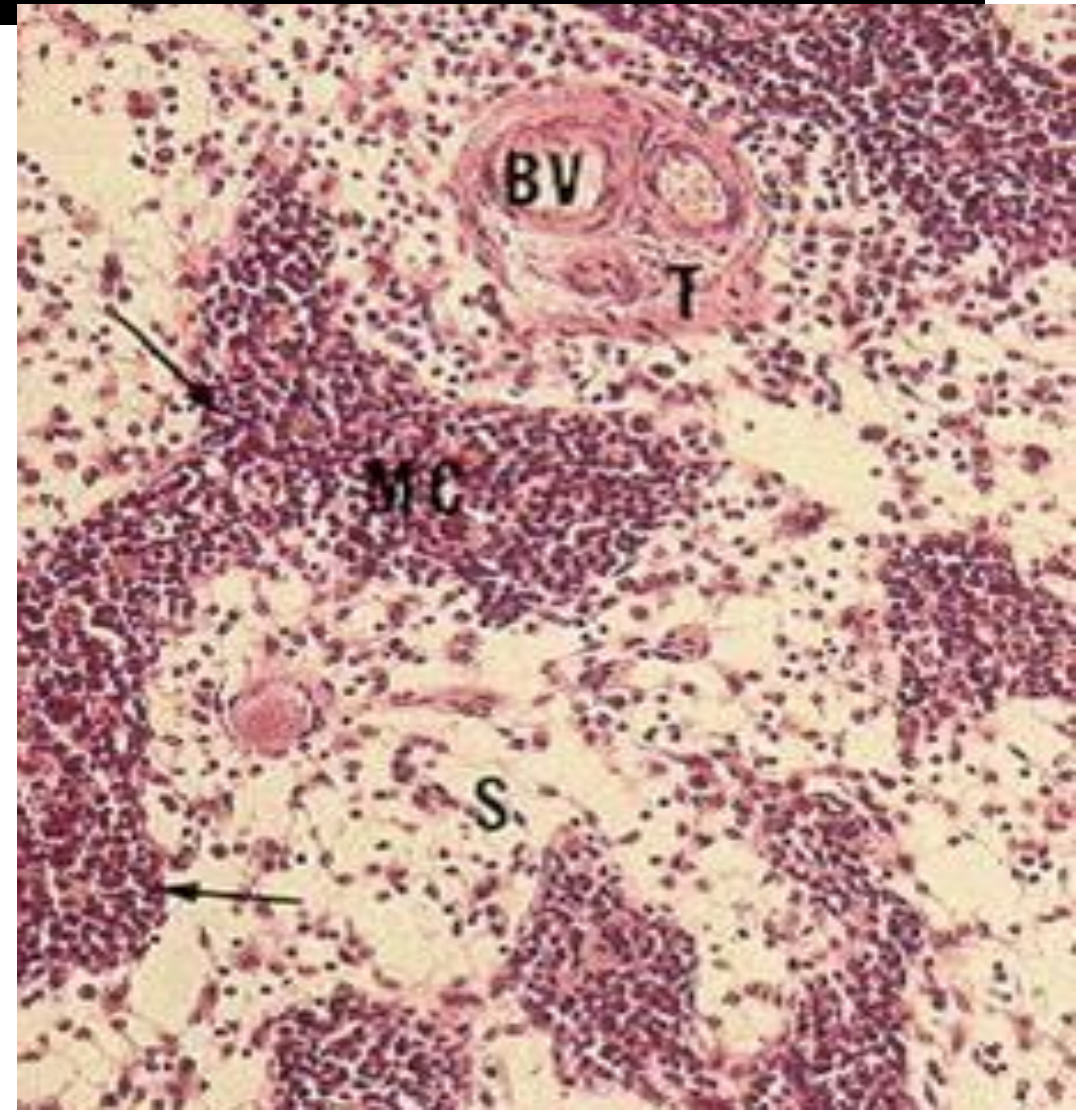


FIGURE 14–15 Lymph node.

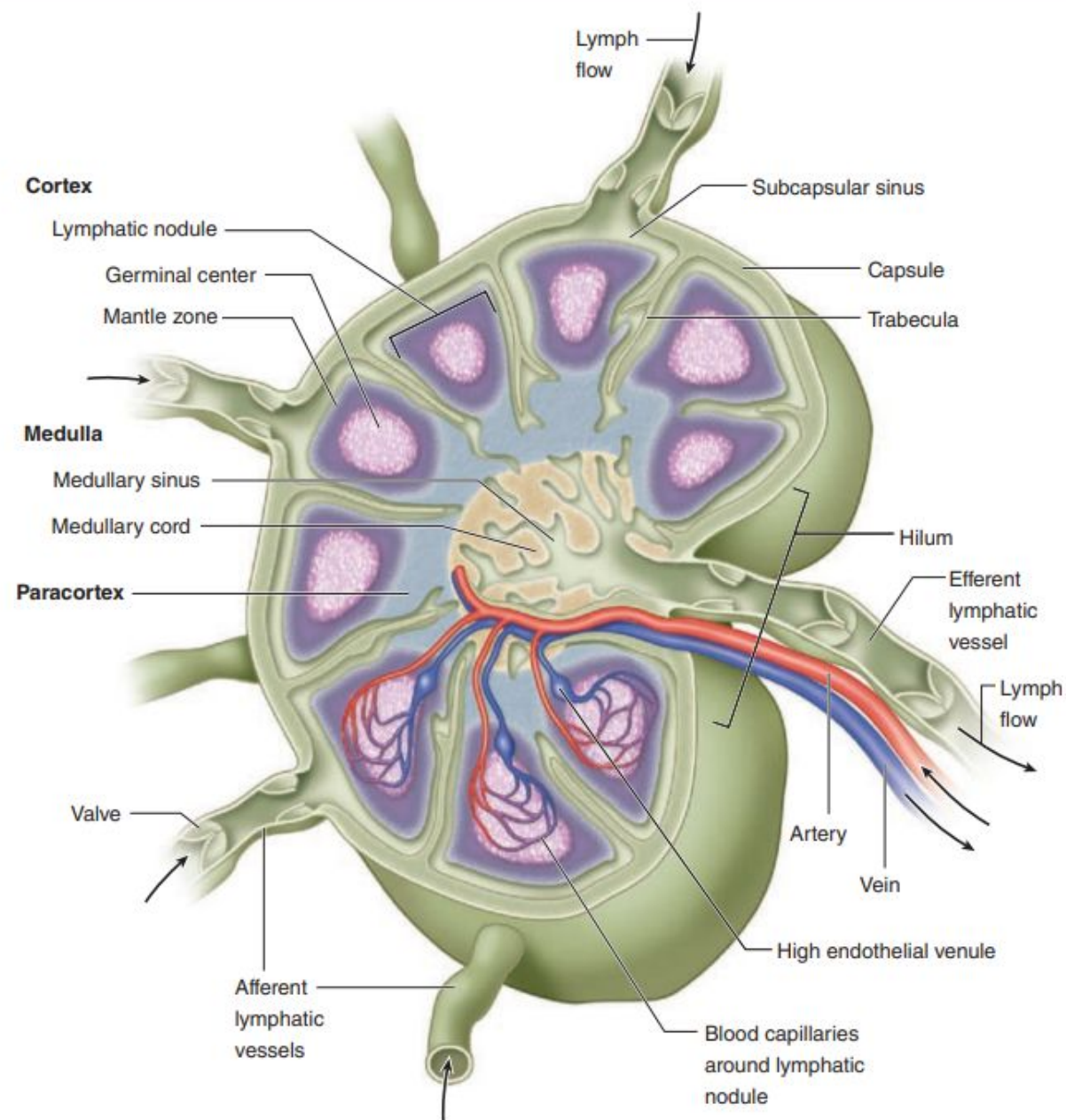
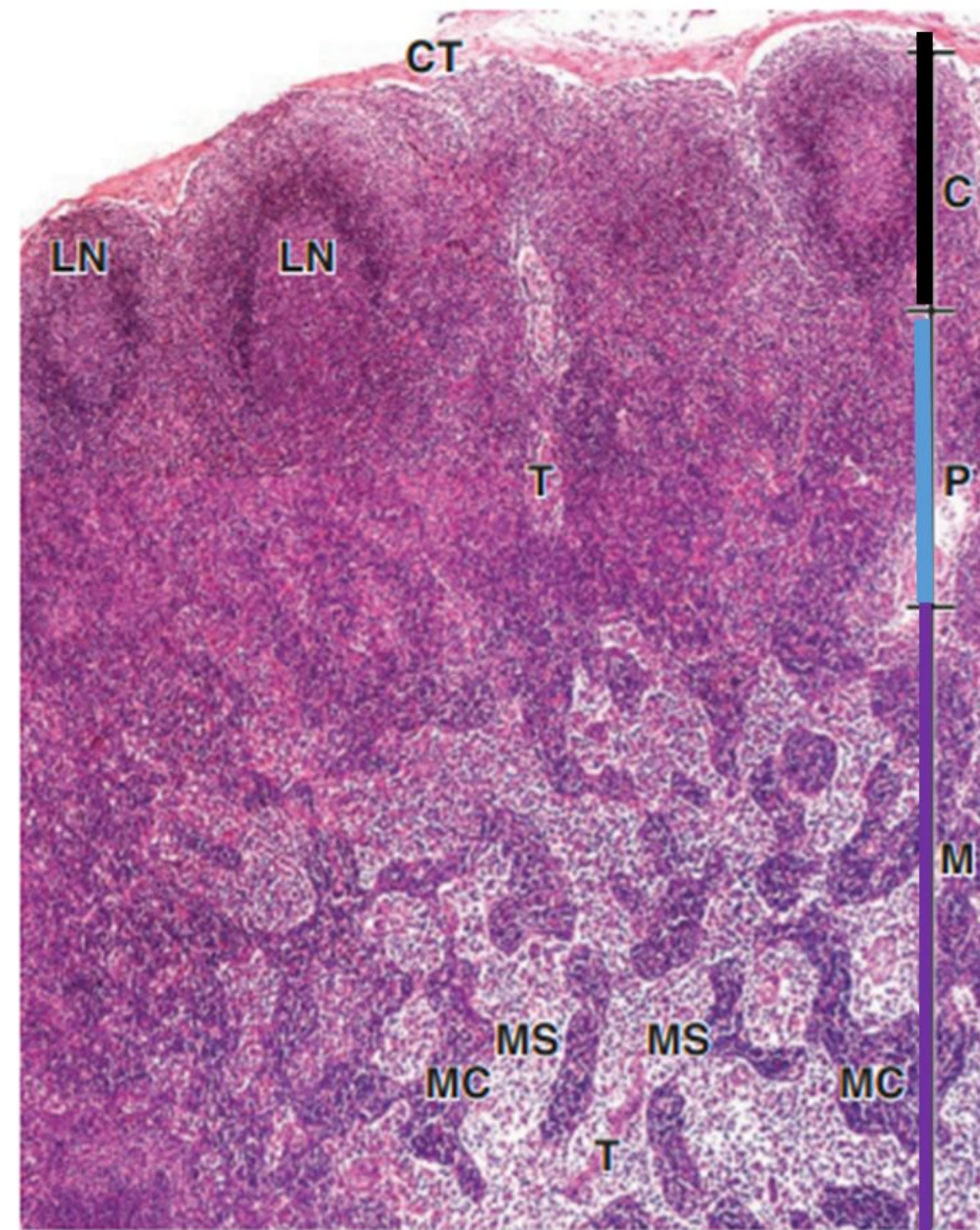


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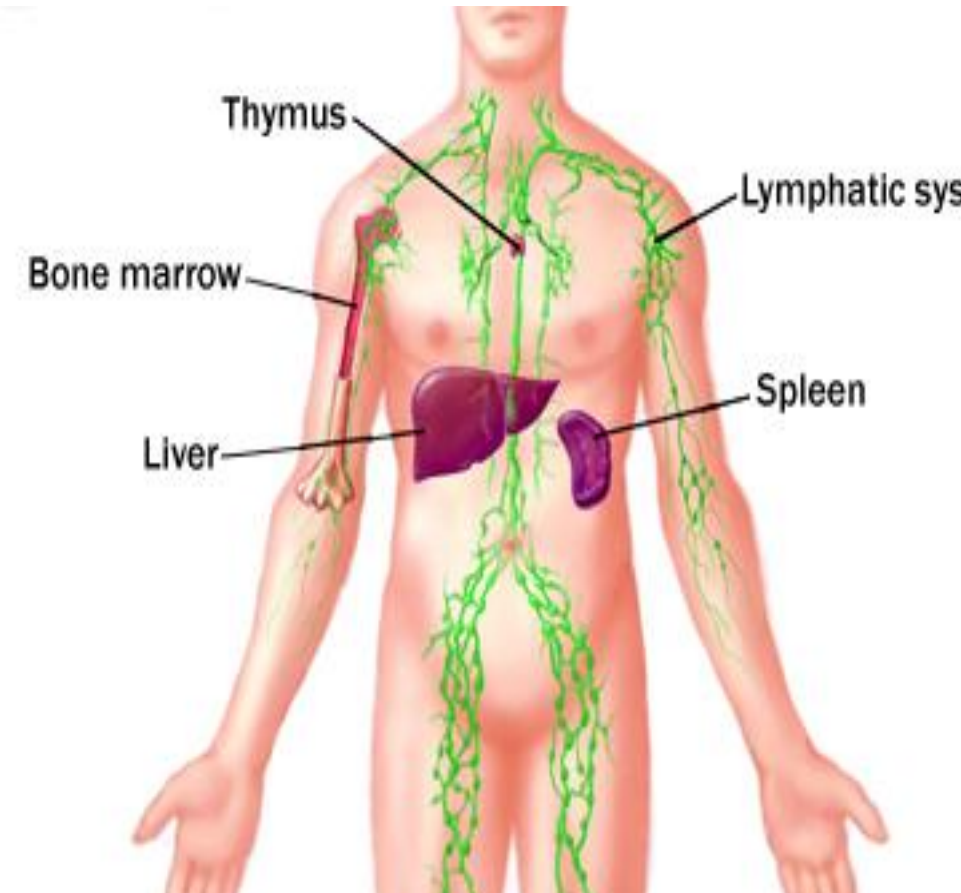
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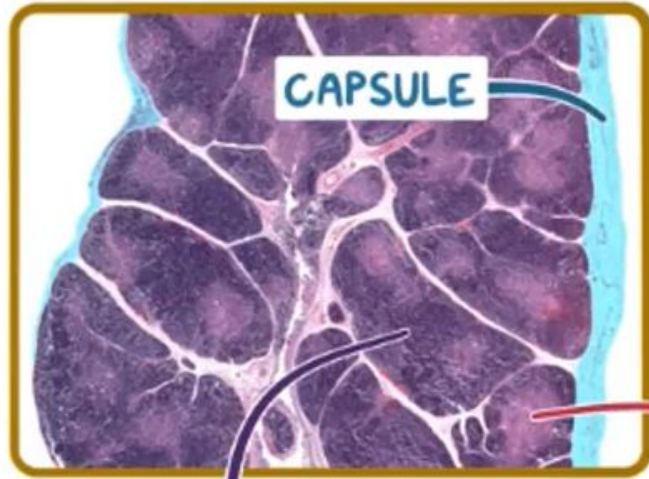
- 2-Secondary (peripheral) lymphoid tissues:

>>*activated (react with foreign antigens):*

- Lymph nodes.
- Spleen.
- MALT.



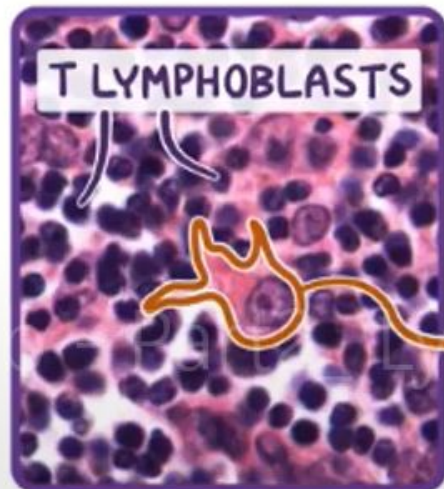
THYMUS



CAPSULE

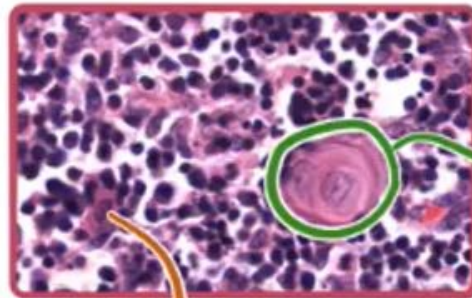
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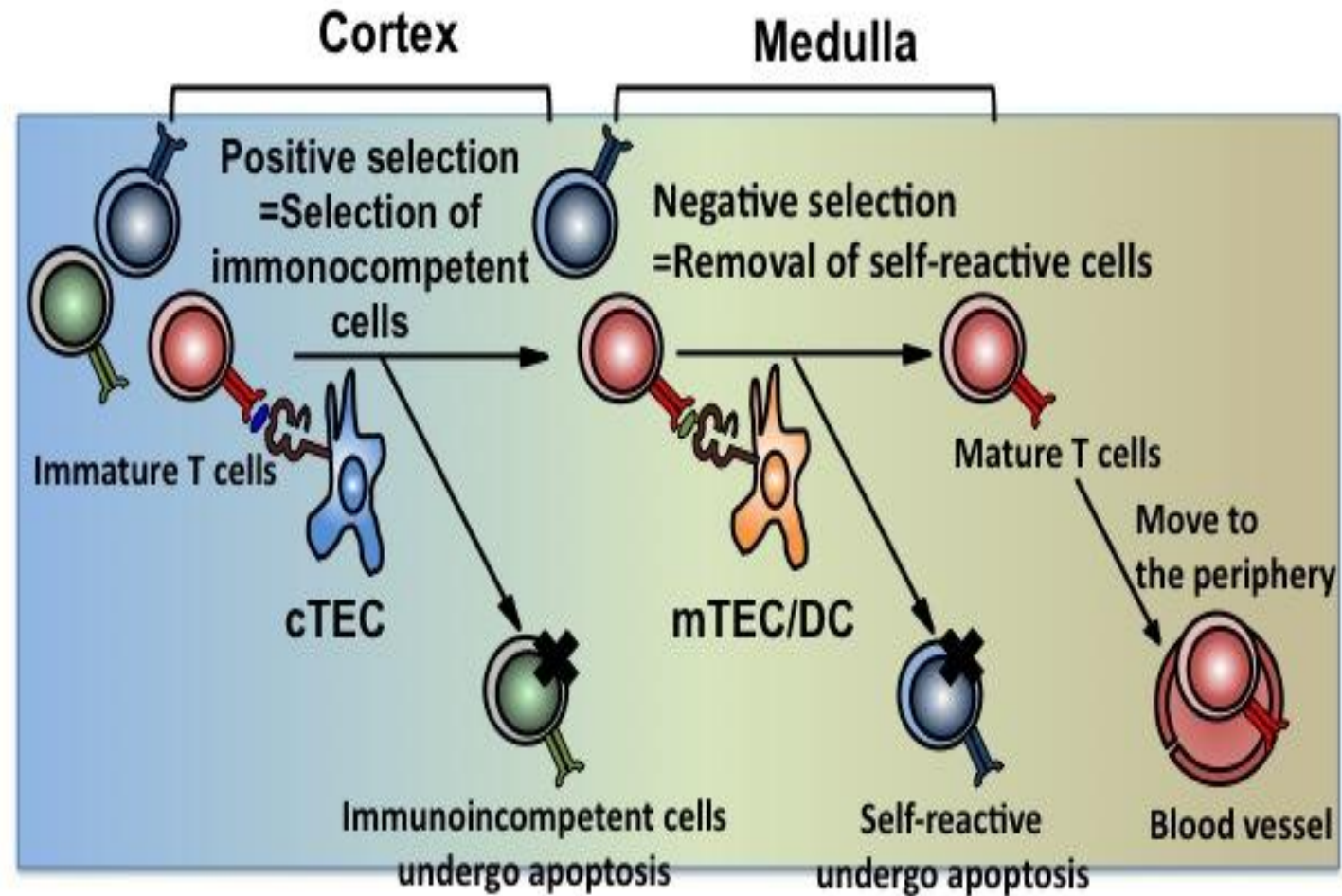


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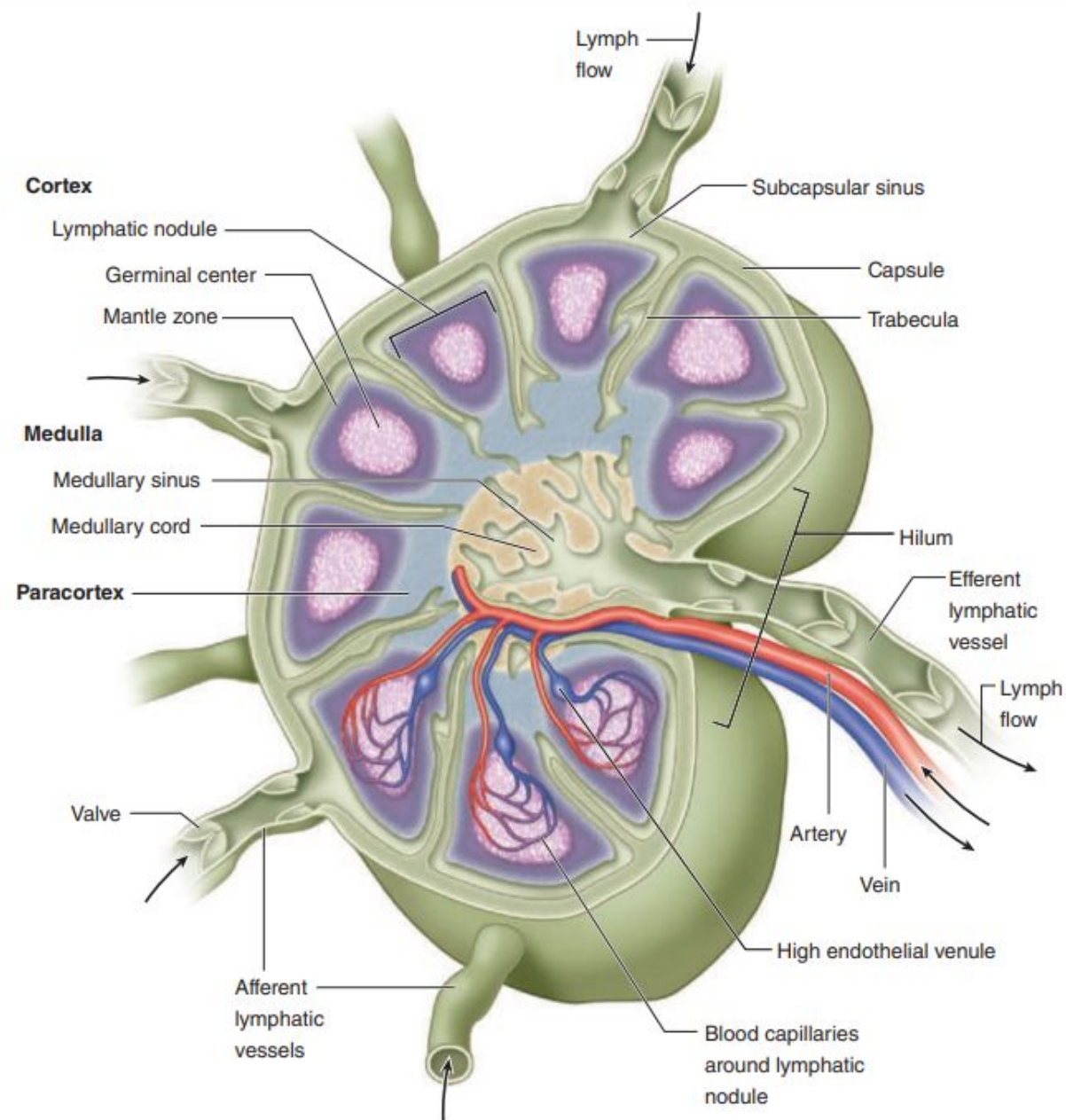
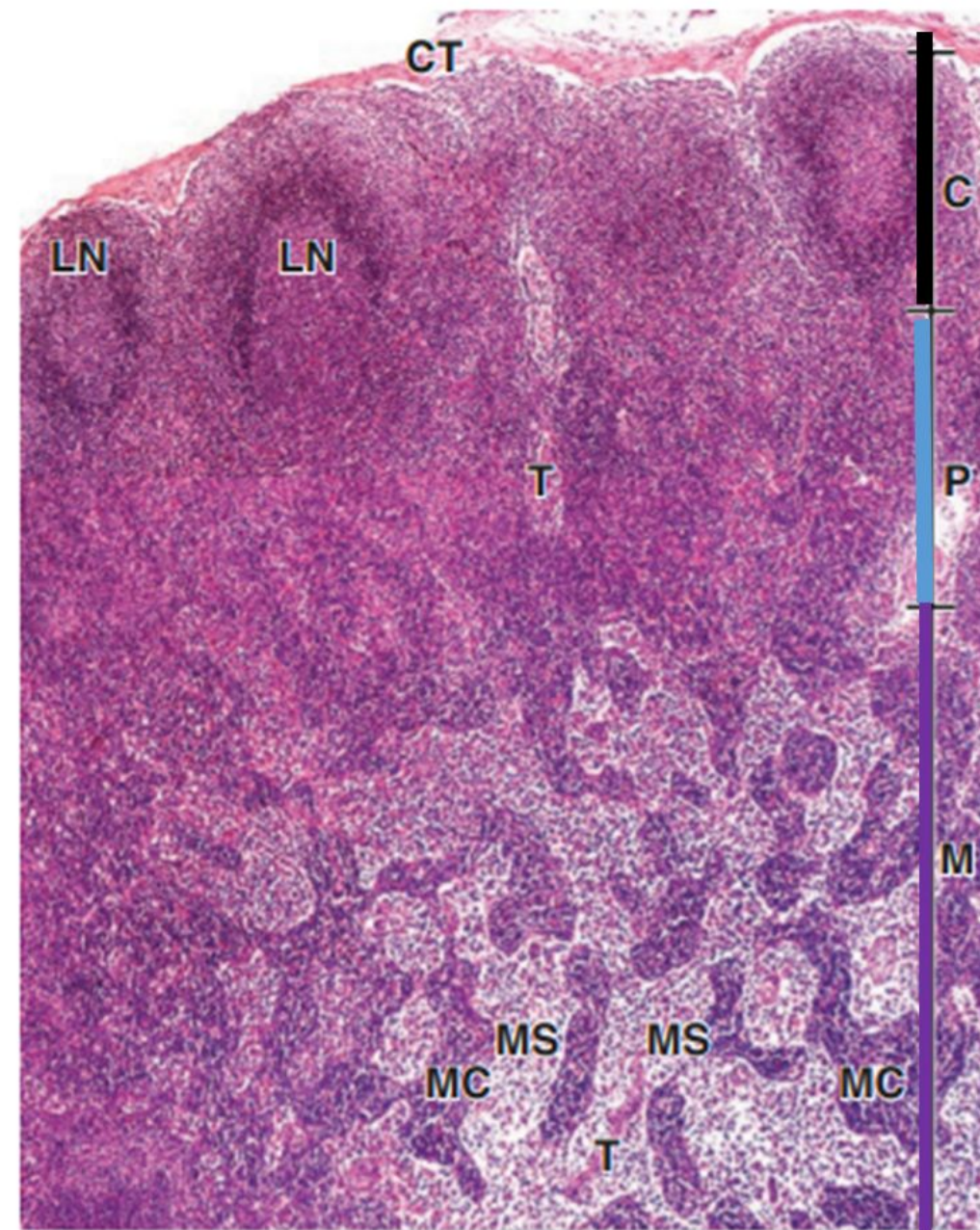


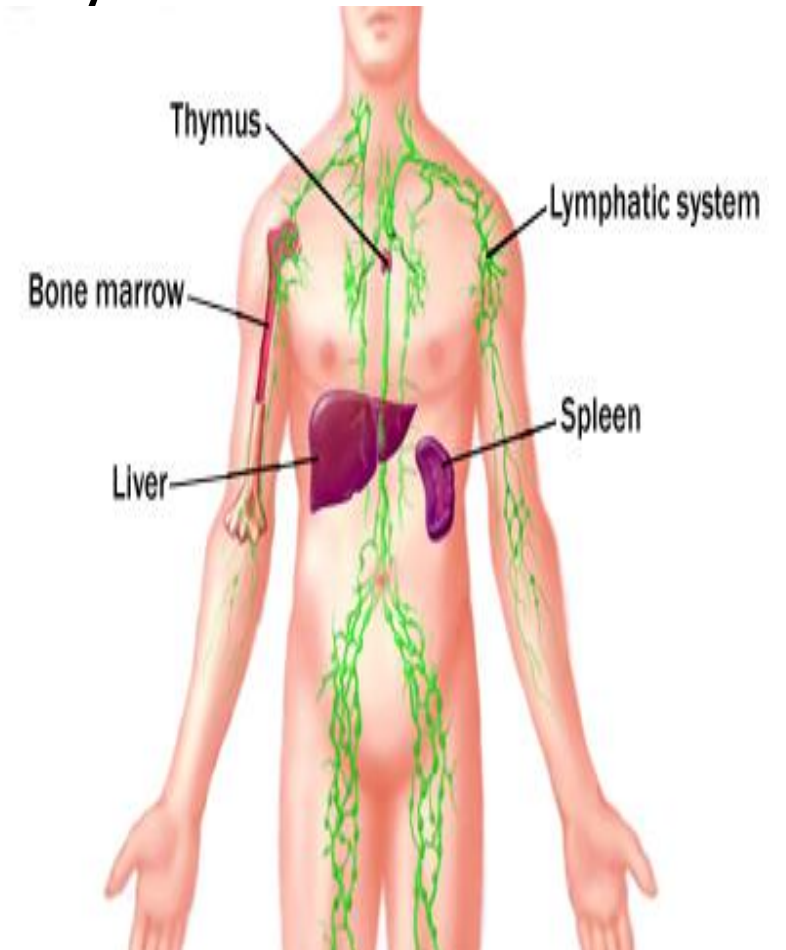
FIGURE 14–16 Regions of a lymph node.

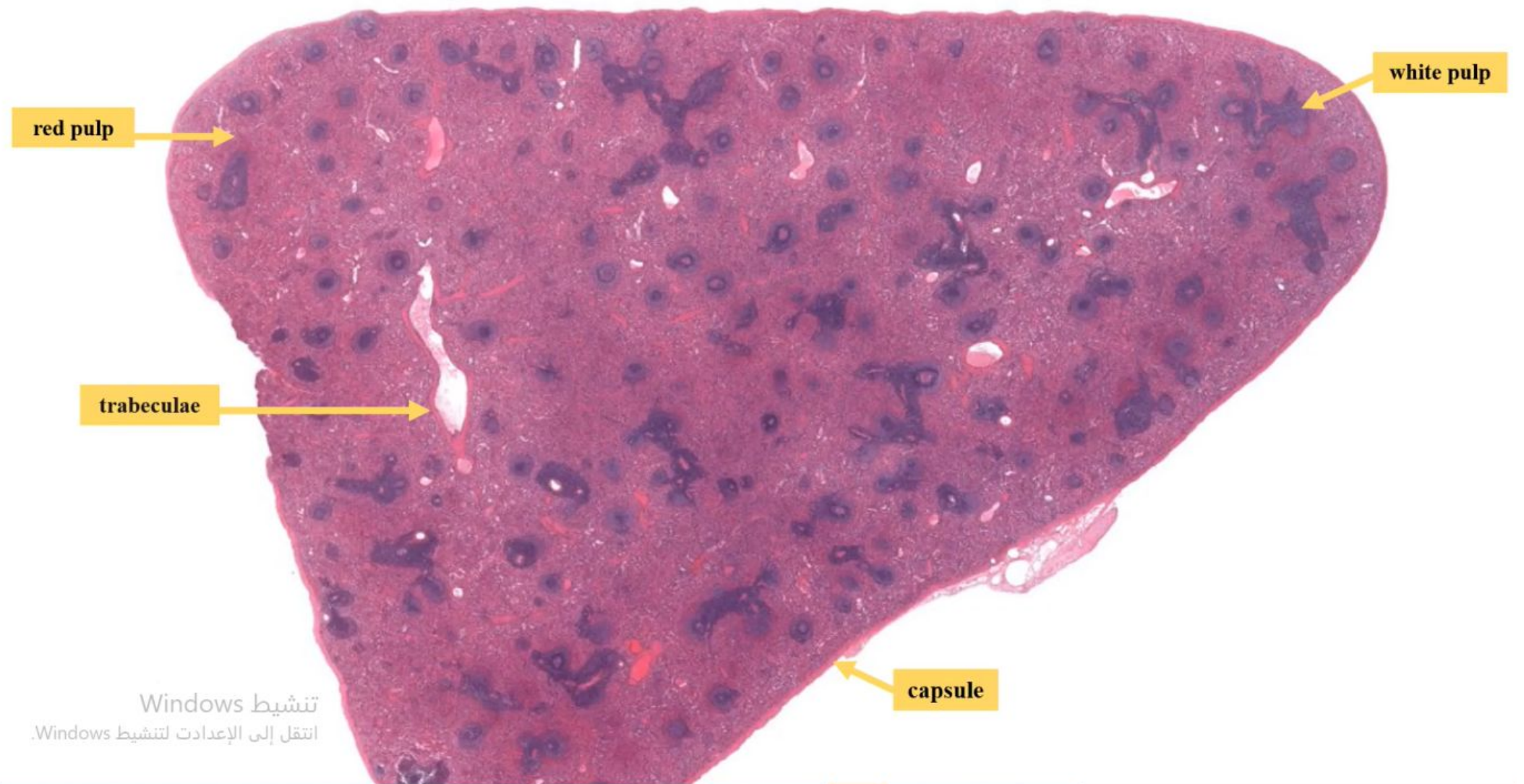


Spleen

Spleen

- The spleen is the largest lymphoid organ in the body.
- Filtration of the blood.
- A production site of antibodies & lymphocytes activation
- RBCs destruction





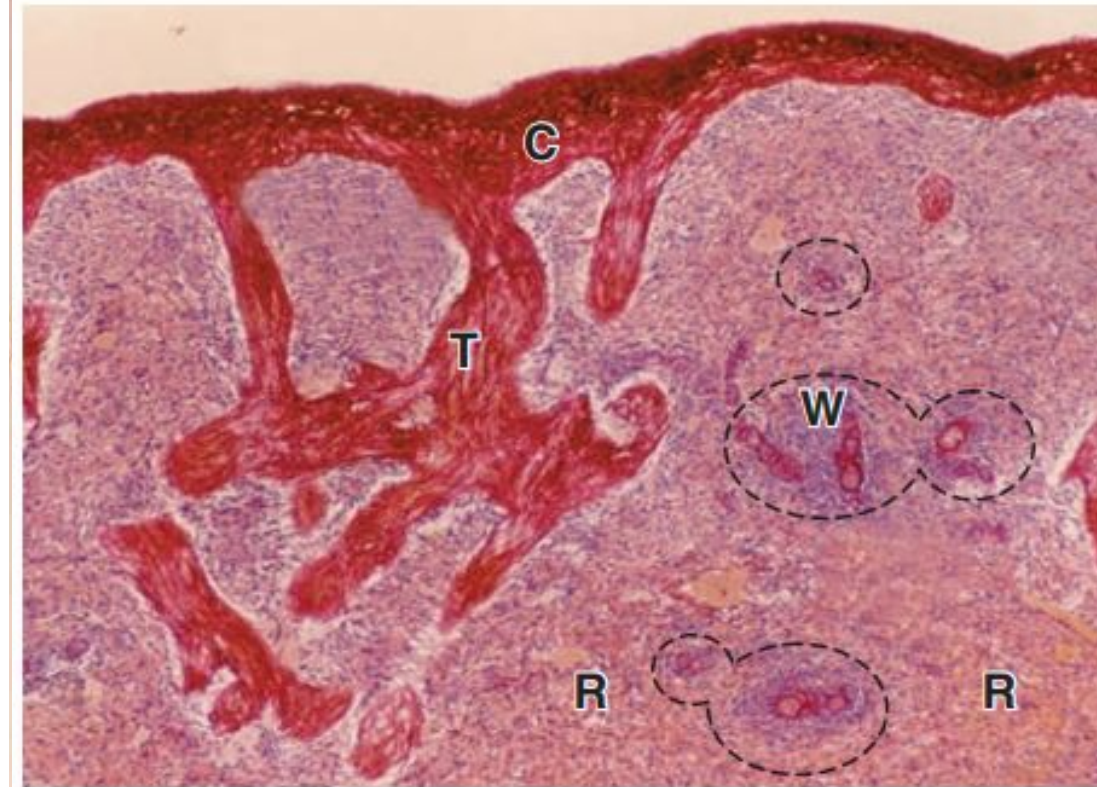
Parenchyma (Splenic pulp)

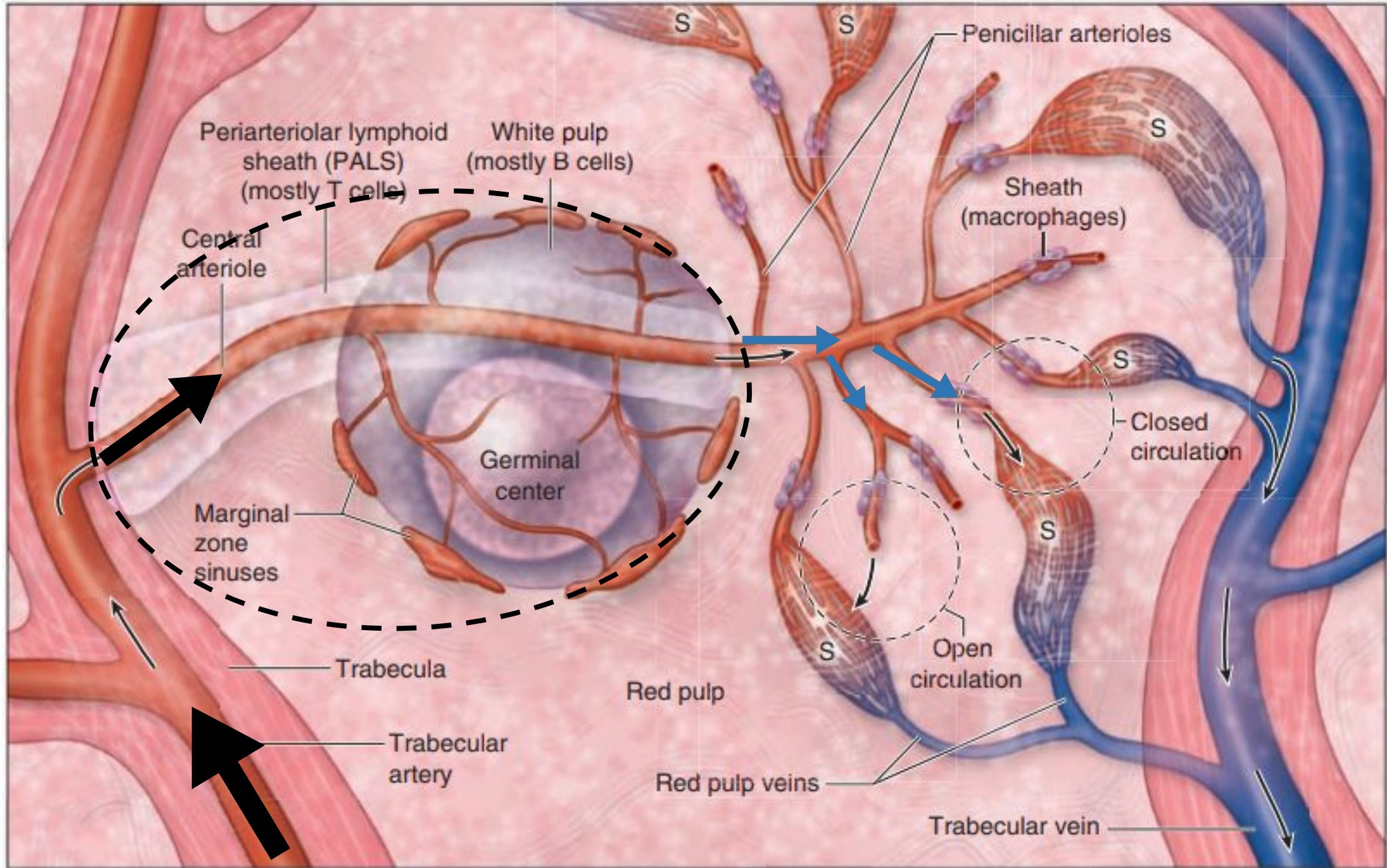
1- White pulp :

- *lymphoid nodules*
- *PALS_Periarterial lymphoid sheaths*

2- Red pulp:

- *Splenic sinusoids*
- *Splenic cords*





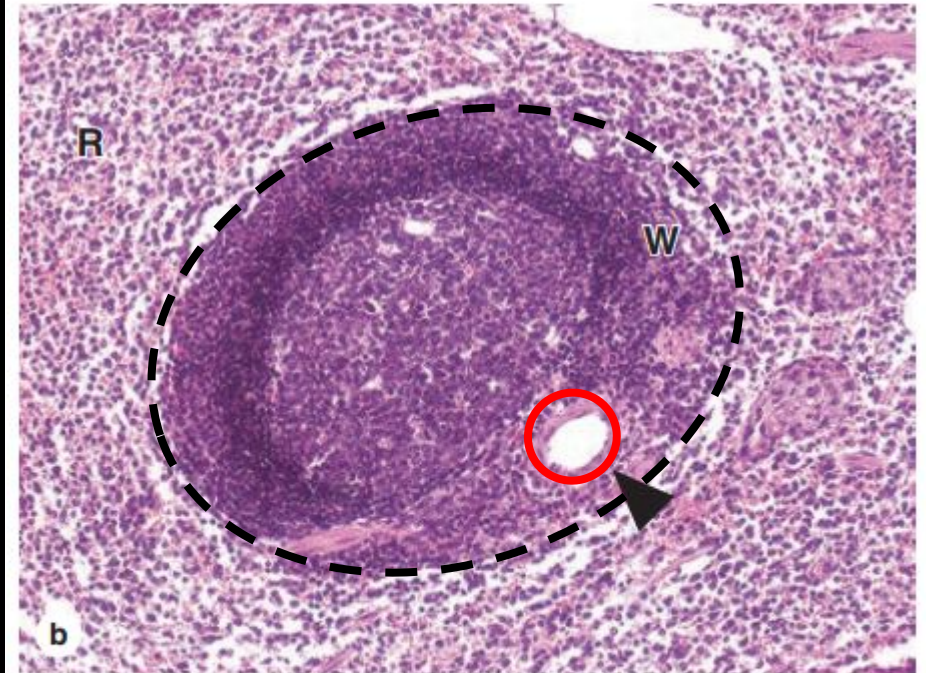
White pulp

- It consists of *lymphoid nodules*, scattered in the substance of the spleen.
- These nodules are formed of B lymphocytes and macrophages, plasma cells.
- The nodules are traversed by *the central artery* !!!**eccentric** in position.

□ *Periarterial lymphoid sheaths* :

T-lymphocytes, MO, other.

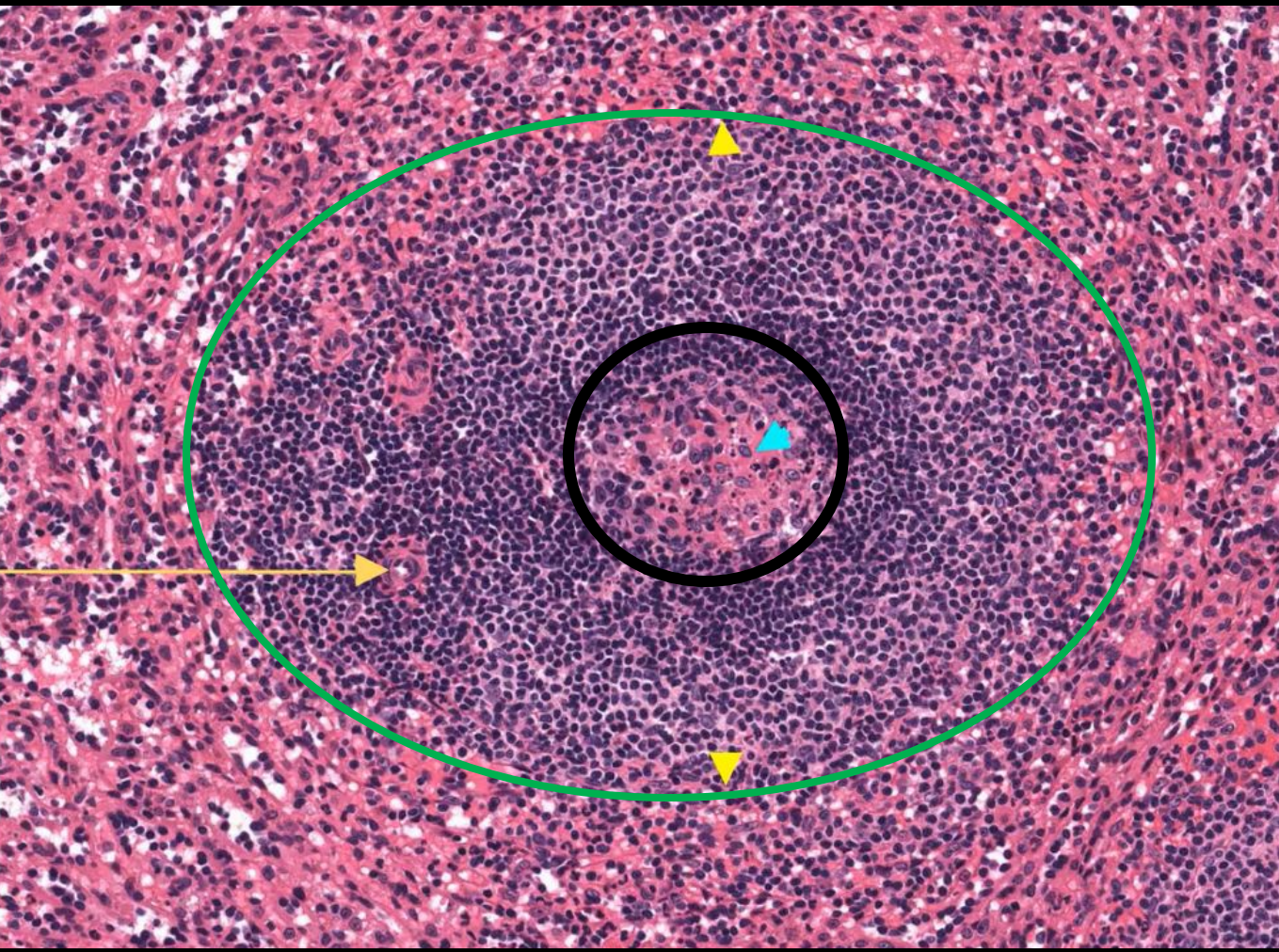
- Germinal zone vs mantle



(b) A large nodule with a germinal center forms in the PALS and the central arteriole (arrowhead) is displaced to the nodule's periphery. Small vascular sinuses can be seen at the margin between white (W) and red (R) pulp. (Both X20; H&E)

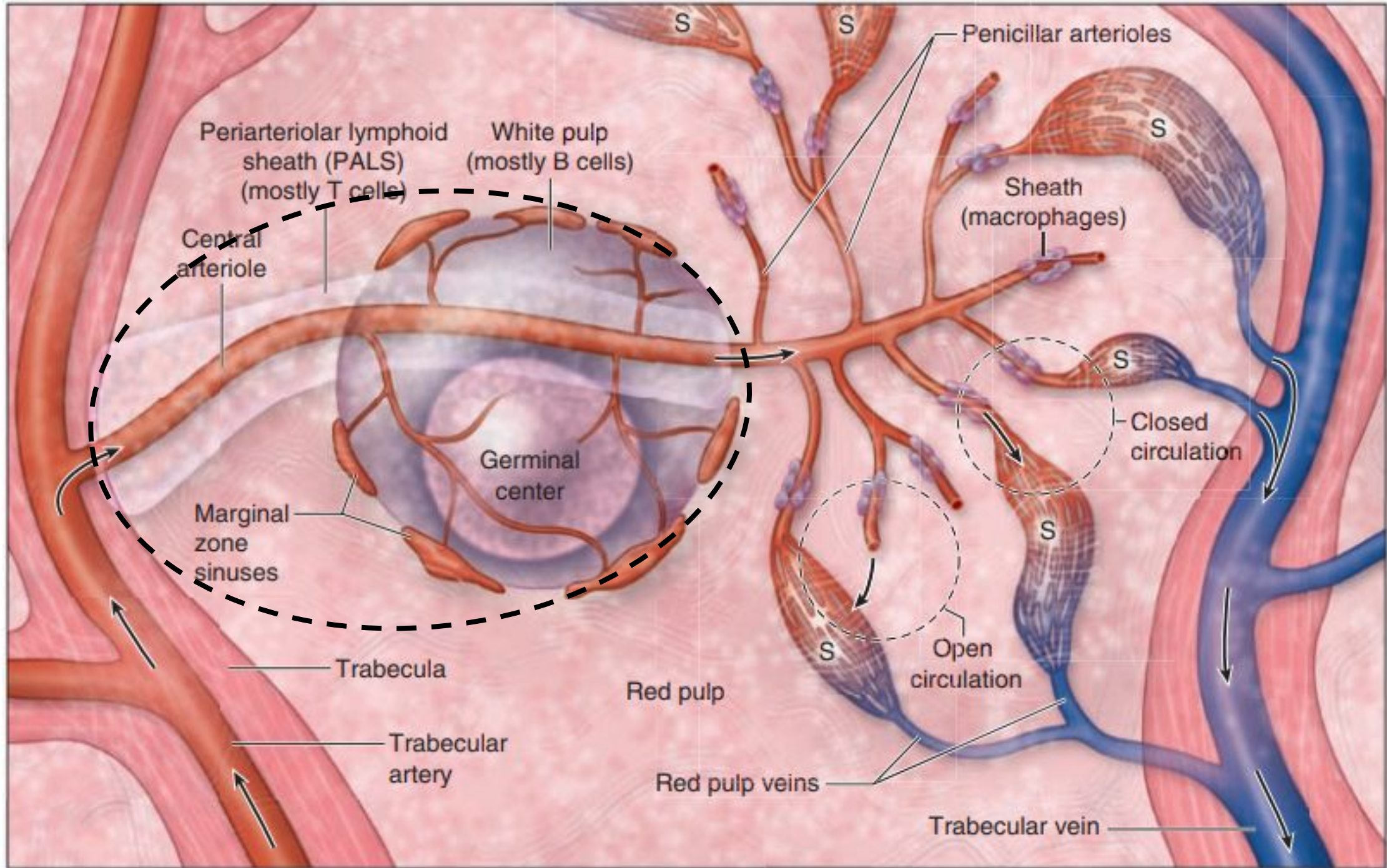
(Used with permission from Dr Paulo A. Abrahamssohn, Institute of Biomedical Sciences, University of São Paulo, Brazil.)

Lymphoid nodule



- germinal zone:
- Eosinophilic
- Proliferating B lymphocytes

- Mantel zone:
- Basophilic
- Inactivated B-lymphocytes



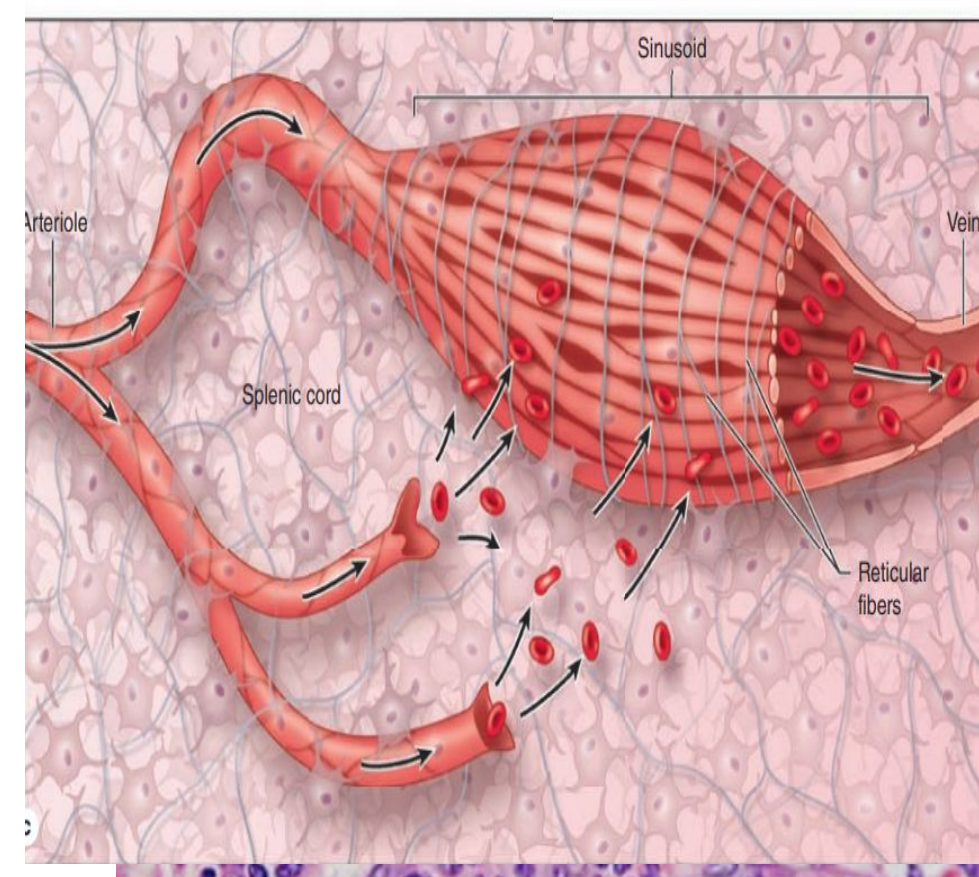
Red pulp

□ *The splenic cords(Bilroth corsds):*

- Reticular cells *fibers, with lymphocytes macrophages, RBCs, and WBC.

□ *The splenic sinusoids:*

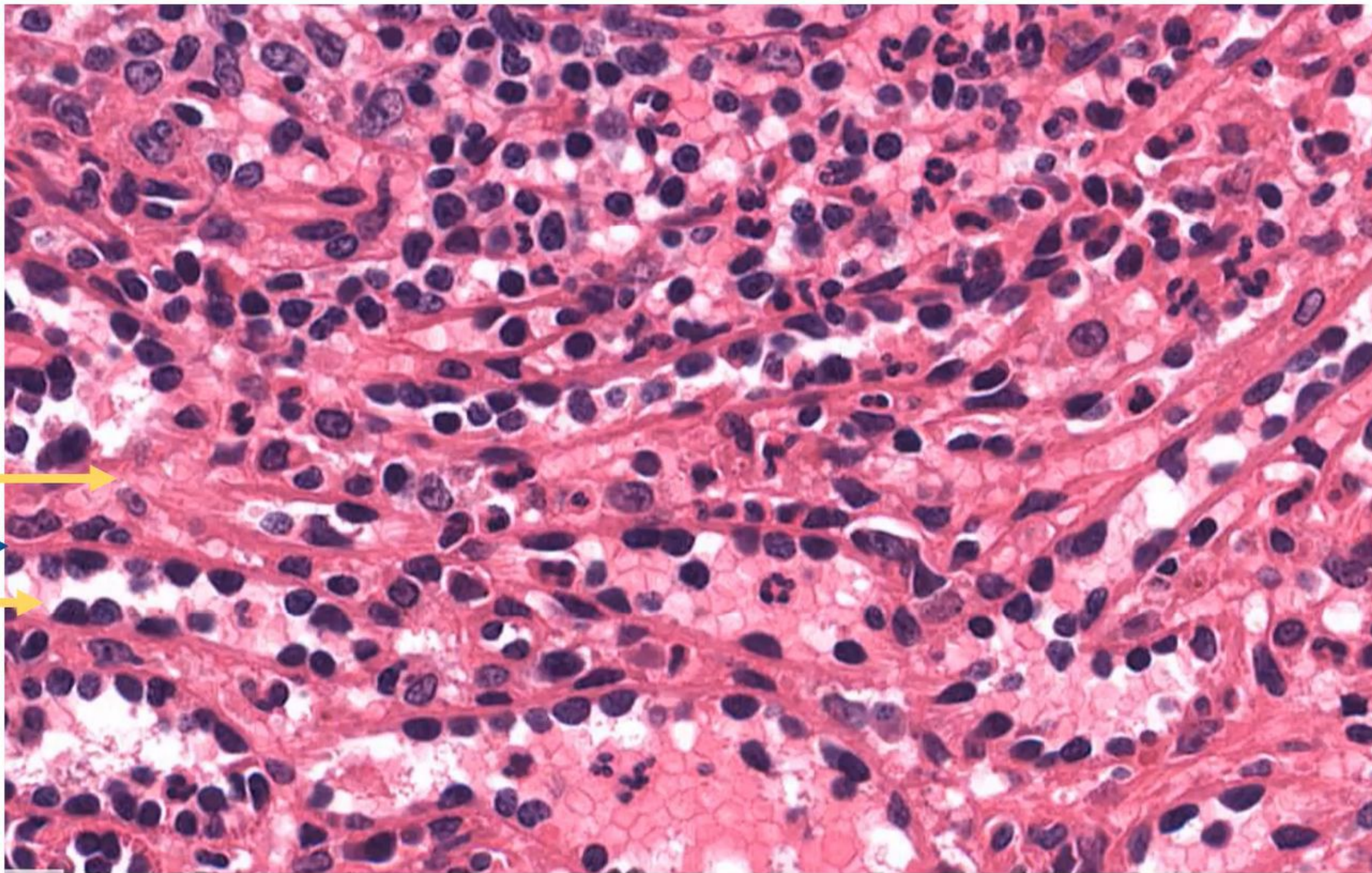
- have slits between the endothelial cells (**Stave cells**), so aged or malformed RBCs are damaged when they pass through these slits and phagocytosed by the macrophages.

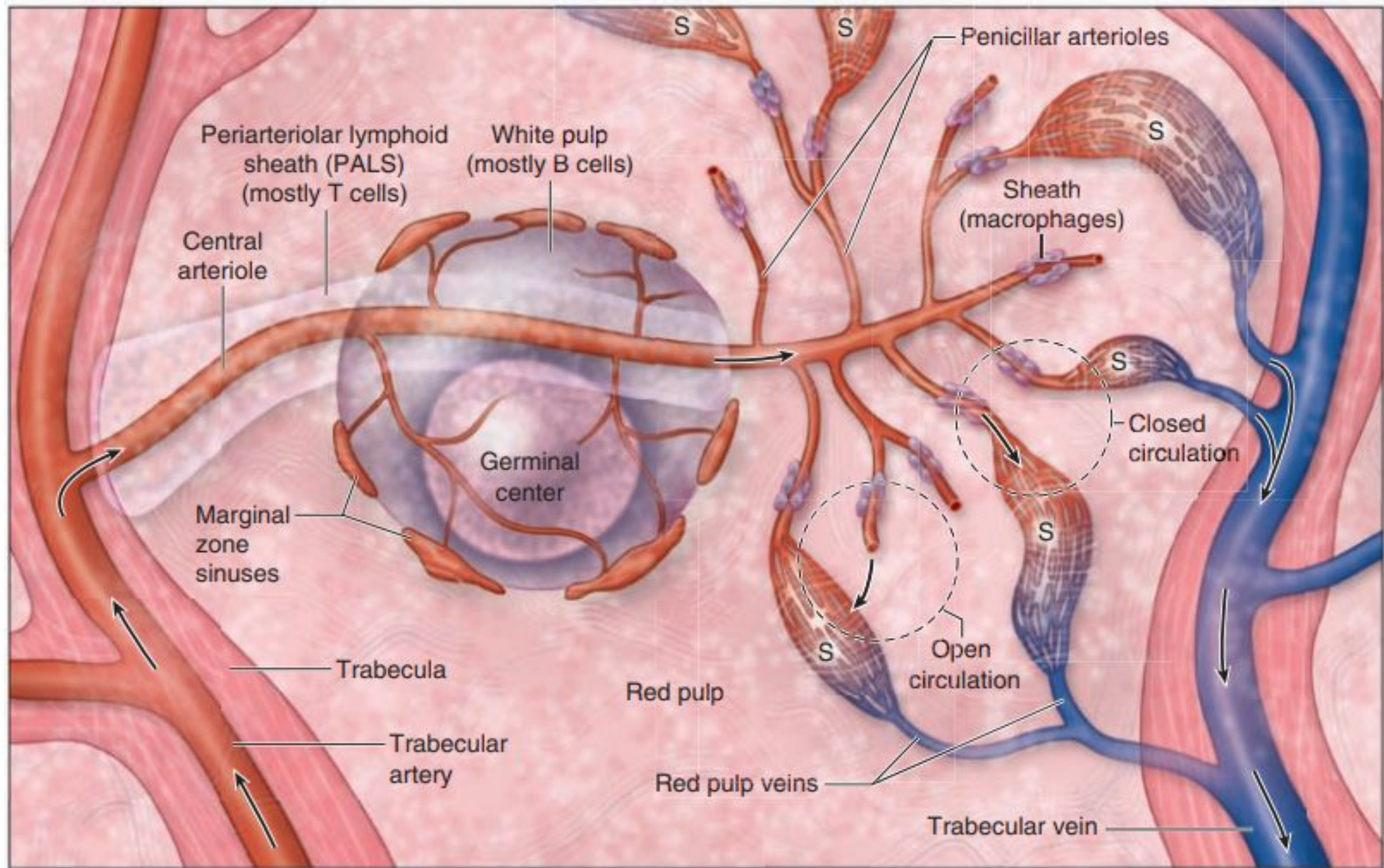


Splenic cords
(of Billroth)

stave cells

Splenic Sinusoids



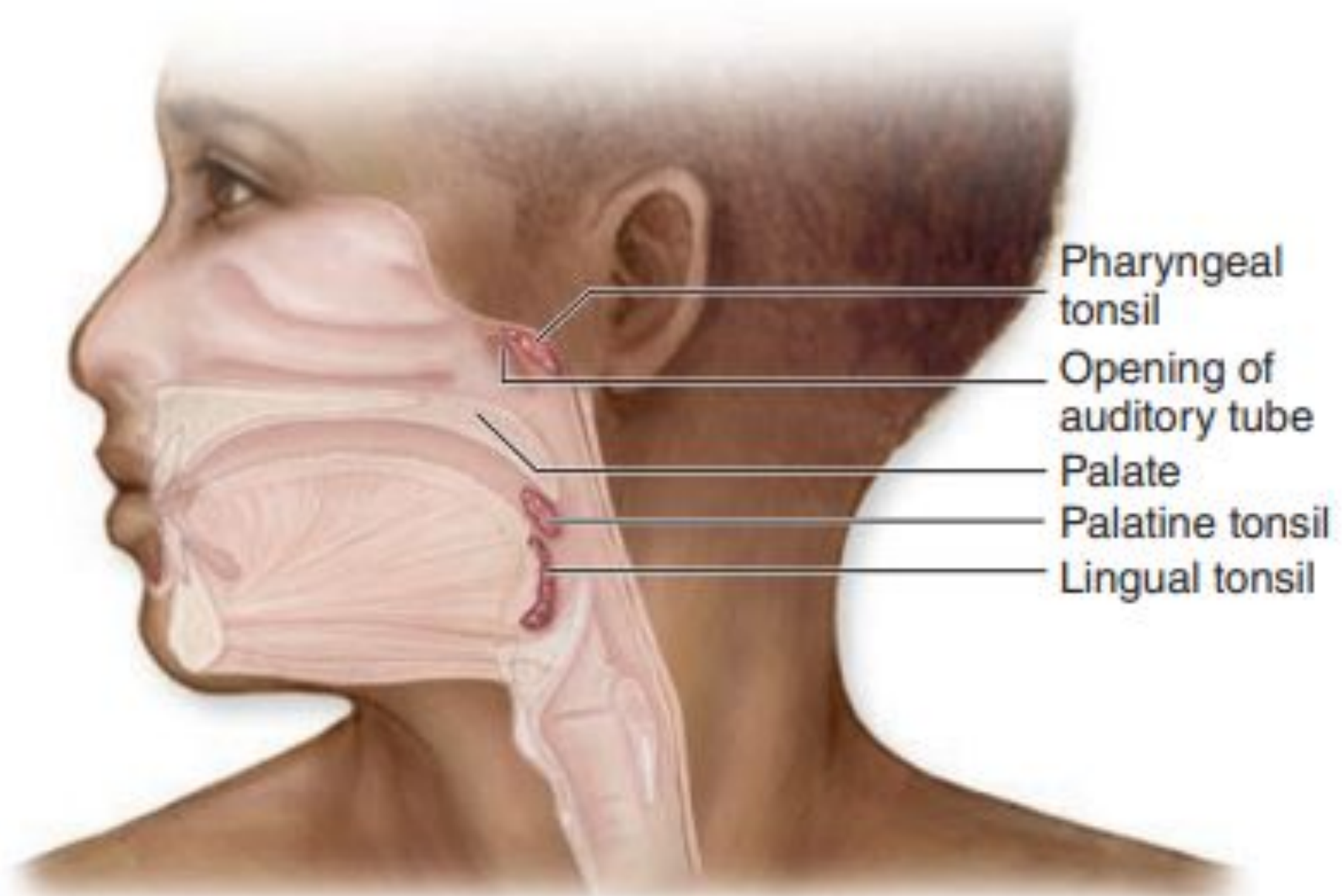


MALT

Mucosa associated lymphoid tissue

MALT

- 70% of lymphoid tissues
- Resp , GI, & genitourinary mucosa is a common site of pathogens invasions.
- Tonsils, Lymphoid nodules in Resp, GI systems, Iliac Peyer patches & appendix.
- **B-lymphocytes, APCs, T-Lymphocytes, others.**



Tonsils

- **Palatine tonsils:**

- **Lingual tonsils:**

Pair of tonsils

Stratified squamous cells

Crypts

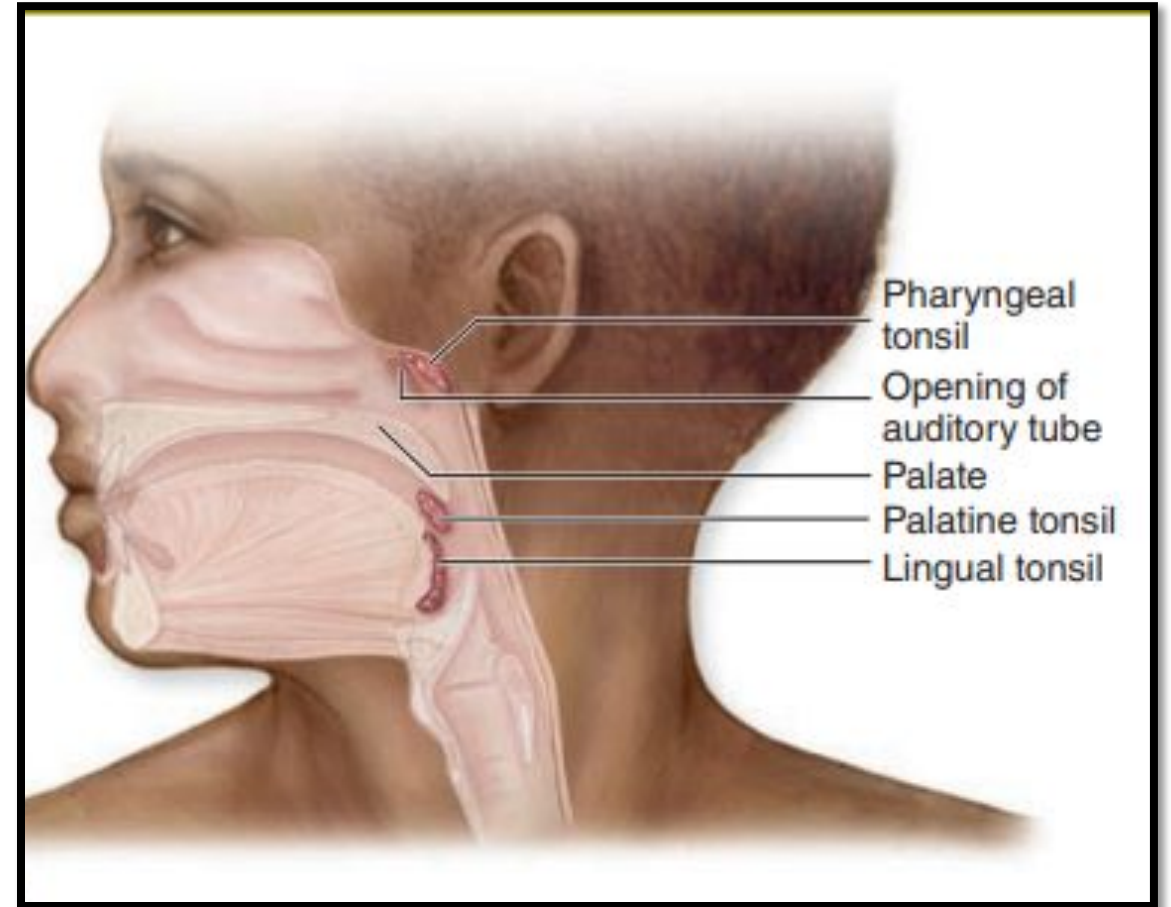
- **Pharyngeal tonsils:**

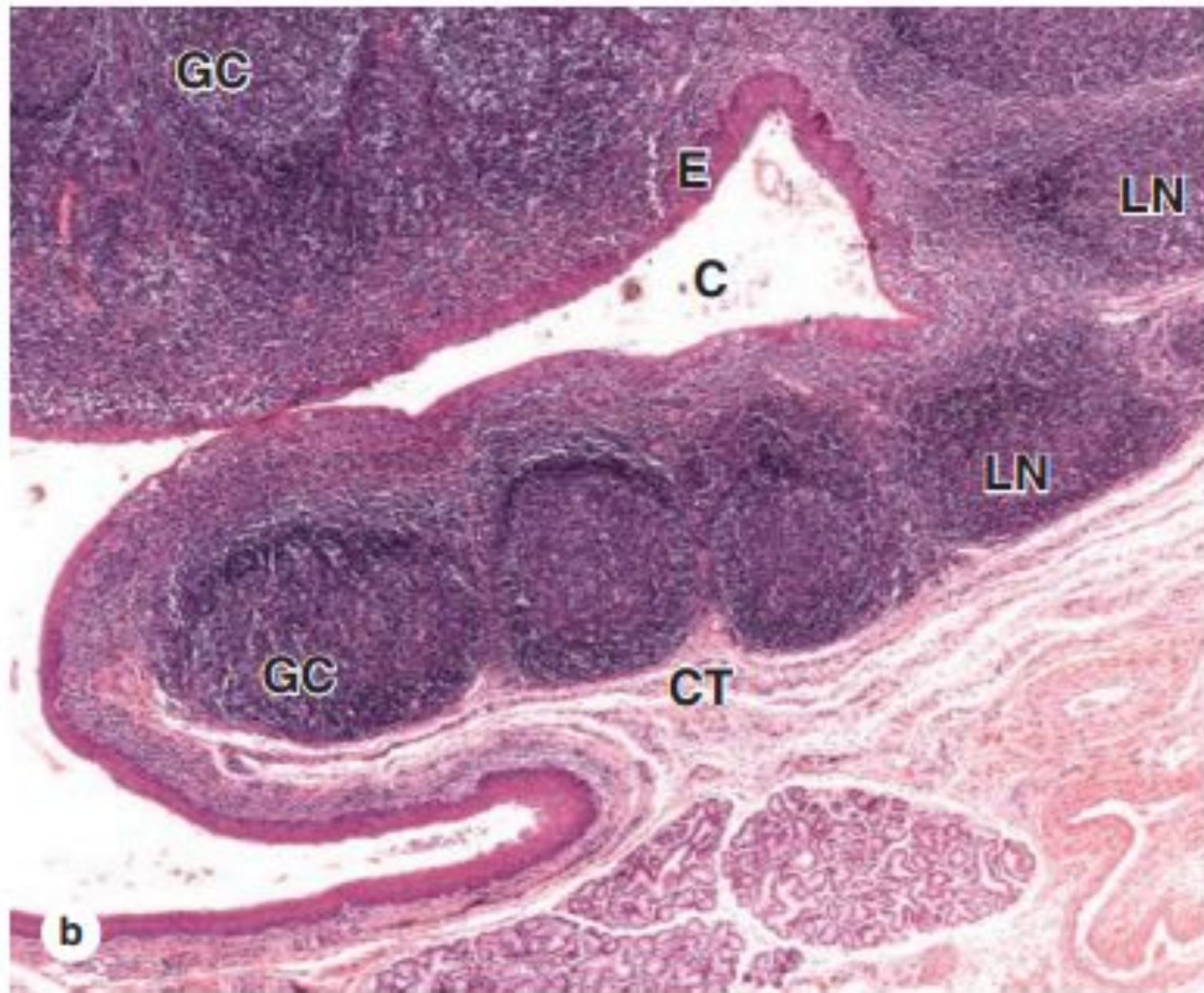
single

pseudostratified ciliated columnar epithelium

Invagination with shallow infoldings

Adenoids





Peyer Patches

- **M-cells (microfold cells):**

Specialized short cells

lacking the brush border surface

deeply invaginated with intraepithelial pocket

FIGURE 14-13 Peyer's patch and M cells.

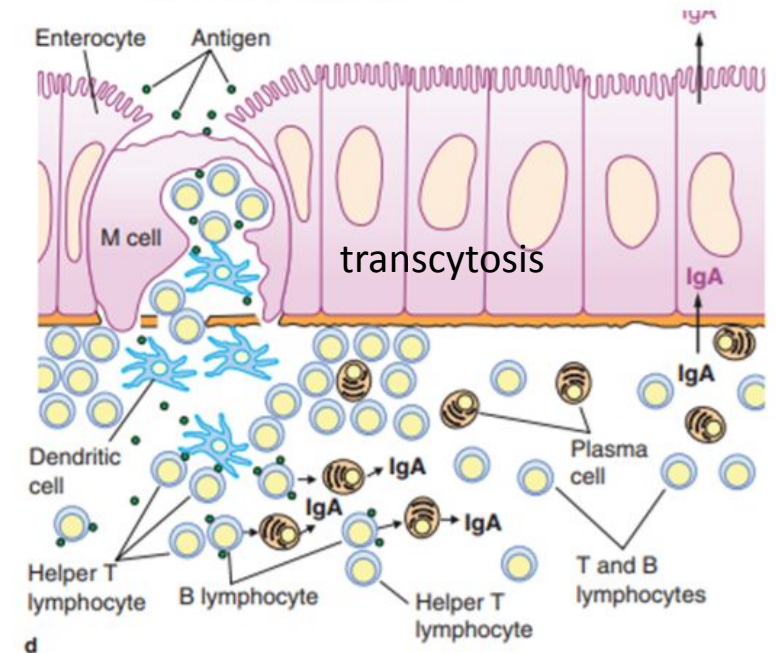


TABLE 14–4**Important histologic comparisons of the major lymphoid organs.**

	Thymus	MALT	Lymph Nodes	Spleen
Cortex/medulla	Distinctly present	Absent	Present	Absent
Lymphoid nodules	Absent	Present	Present (in cortex only)	Present (in white pulp only)
Lymphatic vessels	No afferents; few efferents in septa	No afferents; efferents present	Afferents at capsule, emptying into subcapsular sinus; efferent at hilum	No afferents; efferents in trabeculae
Unique features	Hassall (thymic) corpuscles in medulla; epithelial- reticular cells in cortex and medulla	Crypts lined by surface mucosa in tonsils; epithelial M cells in mucosa over Peyer patches	Thin paracortical region between cortex and medulla, with high endothelial venules (HEV); medullary cords and sinuses	Minor white pulp component, with central arterioles; major red pulp component, with many sinusoids

A close-up photograph of a pair of light-skinned hands, palms up, holding a small, rectangular piece of white paper with deckled edges. The paper is held between the thumbs and index fingers of both hands. On the paper, the words "Thank You" are written in a black, elegant cursive script. The background is a solid, dark color, making the hands and the white paper stand out.

Thank You